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ESA study:

End-to-end GNSS Occultation Performance Simulator (EGOPS) Enhancement

[ESA/ESTEC contract no. 13327/98/NL/GD-CCN1, WP2.4: Preparation of updated Software User Manual (SUM)]

Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement

EGOPS4 S oftware U ser M anual

Reference Manual

Software User Manual, Part 2 of 2, Doc. No. IGAMUG/ESA-EGOPS4/SUM-REF
[Document *EGOPS4_SUM-REF*]

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1 Introduction

1.1 Scope

This document (EGOPS4_SUM-REF.pdf) is Part 2 of the Software User Manual for the End-to-end GNSS Occultation Performance Simulator, Version 4 [SUM], termed Software User Manual – Reference Manual [SUM-REF], which gives the detailed description of the various EGOPS functions, tasks and system operations. The operations are listed according to the EGOPS logical work-flow.

Part 1 of the Software User Manual for the End-to-end GNSS Occultation Performance Simulator, Version 4 (EGOPS4_SUM-OV.pdf) is the Software User Manual – Overview Manual [SUM-OV], which provides an overview description of the EGOPS simulator and its capabilities.

1.2 Abbreviations and Acronyms

AD	Architectural Design
ADD	Architectural Design Document
ATPRO	Atmospheric Profiling
CIRA	COSPAR International Reference Atmosphere
COSPAR	Committee on Space Research
CRI	Computer Resources International A/S
DDD	Detailed Design Document
DMI	Danish Meteorological Institute
ECHAM(4)	Atmosphere/Climate model developed at MPI Hamburg (Version 4)
ECMWF	European Centre for Medium-Range Weather Forecasts
EGOPS®	End-to-end GNSS Occultation Performance Simulator (generic)
EGOPS2	End-to-end GNSS Occultation Performance Simulator, Version 2
EGOPS3	End-to-end GNSS Occultation Performance Simulator, Version 3
EGOPS4	End-to-end GNSS Occultation Performance Simulator, Version 4
ESA	European Space Agency
ESTEC	European Space Agency Technology Center
FoMod	Forward Modeling
GLONASS	(Russian) Global navigation satellite system
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRIB	Gridded Binary (file format for meteorological data)
HOOD	Hierarchical Object Oriented Design
IDL	Interactive Data Language
IEEE	Institute of Electrical and Electronics Engineer
IEMC	International EGOPS Maintenance Center
IGAM/UG (*)	Institute for Geophysics, Astrophysics, and Meteorology/University of Graz
IMG/UoG	Institute for Meteorology and Geophysics/University of Graz
InRet	Inversion/Retrieval
LEO	Low Earth Orbit
MAnPl	Mission Analysis/Planning
MPI	Max-Planck Institute (for Meteorology, Hamburg)
MPS	Multiple Phase Screen
MSISE90	Global atmospheric model MSISE90 ([HEDIN91])
MSIS90_DMI	MSISE90 variant (modifications by DMI)
NeUoG	Global ionospheric model NeUoG
OSMod	Observation System Modeling
ReFlexPortEx	Reliability, Flexibility, Portability, Extendibility
RO	Radio Occultation(s)
ROSAP	Radio Occultation Simulation for Atmospheric Profiling
SA	Selective Availability
SPD	Space Division
SRD	Software Requirements Document
TBD	To Be Defined
TEC	Total Electron Content

TERMA	TERMA Elektronik AS
URD	User Requirements Document

(*) Note: As of December 3, 1999, IGAM/UG is the legal successor of IMG/UoG.

1.3 Terms and Definitions

Project — A group of simulation and visualization/validation activities whose output is separated from that of other projects. A project is identified by its user specified Project-id.

Task — A simulation activity within a project. Four Tasks are generically available in EGOPS. Mission Analysis/Planning, Forward Modeling, Observation System Modeling, and Occultation Data Inversion/Retrieval. A specific task is identified by its user-specified Task-id.

Toolkit — A group of software tools with related purposes.

2 Document References

2.1 Applicable Documents

The documents which are applicable for this document are:

[EGOPSEXT] Kirchengast, G., Proposal for an "End-to-end GNSS Occultation Performance Simulator (EGOPS) Extension Study"; *IGAM/UG Doc.Id.: IGAMUG/ESA-EGOPSE/ CCN2/1,* Proposal to ESA/ESTEC, March 27, 2000.

[EGOPSECCN1] Kirchengast, G., Proposal for Contract Change Notice (CCN) to ESTEC Contract No. 13327/98/NL/GD "End-to-end GNSS Occultation Performance Simulator (EGOPS) Enhancement Study"; Initiator of Change: P. Silvestrin/ESTEC; *IGAM/UG Doc.Id.: IGAMUG/ESA-EGOPSE/CCN1/1,* Proposal to ESA/ESTEC, February 14, 2000.

[EGOPSE] Kirchengast, G., J. Ramsauer, W. Muehlmann (now W. Poetzi), M. Gorbunov, G. Holler, M. Rieder, P. Hoeg, G.B. Larsen, and S. Syndergaard, End-to-end GNSS Occultation Performance Simulator (EGOPS) Enhancement, *IMG/UoG Proposal to ESA/ESTEC,* October 15, 1998; supplemented by Minutes of Kick-off meeting held at ESTEC on November 6, 1998.

[SPV] Proposal 96-53 to ESTEC for GNSS Simulation and Performance Verification, CRI/SPD/PRO/96-53, July 1996.

[ATMSOU] Proposal 95-52 for Atmospheric Sounding with GNSS Occultation, CRI/SPD/PRO/95-52, December 1995; supplemented by the draft contract annexed to the Minutes of Negotiation Meeting, CRI/15AS/MIN/96.

[PSS-05] ESA Software Engineering Standards, Doc. PSS-05-0, Issue 1, February 1991.

2.2 Reference Documents

The documents, except for the applicable documents, which are referenced in this document are:

[URD/SRD] Poetzi, W., J. Fritzer, G. Kirchengast, Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement, User Requirements Document/Software Requirements Document, *IGAM/UG Technical Report for ESA/ESTEC No. 3/2001,* Doc. No. IGAMUG/ESA-EGOPS4/URD-SRD, Issue 4, May 2001.

[ADD/DDD] Poetzi, W., G. Kirchengast, J. Fritzer, J. Ramsauer, and M. Gorbunov, Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement, Architectural Design Document/Detailed Design Document, *IGAM/UG Technical Report for ESA/ESTEC No. 4/2001,* Doc. No. IGAMUG/ESA-EGOPS4/ADD-DDD, Issue 3, May 2001.

[SUM] Kirchengast, G., J. Fritzer, and J. Ramsauer, Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement, EGOPS4 Software User Manual, *IGAM/UG Technical Report for ESA/ESTEC No. 5/2001,* Doc. No. IGAMUG/ESA-EGOPS4/SUM, Issue 1, September 2001.

[SUM-OV] Kirchengast, G., J. Fritzer, and J. Ramsauer, Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement, EGOPS4 Software User Manual – Overview Manual, *IGAM/UG Technical Report for ESA/ESTEC No. 5/2001,* Doc. No. IGAMUG/ESA-EGOPS4/SUM-OV, Issue 1, September 2001.

[SUM-REF] Kirchengast, G., J. Fritzer, and J. Ramsauer, Atmospheric Sounding with GNSS Occultation / EGOPS Enhancement, EGOPS4 Software User Manual – Reference Manual, *IGAM/UG Technical Report for ESA/ESTEC No. 5/2001,* Doc. No. IGAMUG/ESA-EGOPS4/SUM-REF, Issue 1, September 2001.

[IEEE-610.12] IEEE Standard Glossary of Software Engineering Terminology, Doc. ANSI/IEEE Std. 610.12-1990, 1990.

3 About the Manual

3.1 Intended Readership

The users of the software are expected to be scientists and engineers with the following potential expectations and reasons for using the software (note that in practice a „scientist“ and an „engineer“ may well reside in one physical person whatever its specific profession or job is; not uncommon in potential user organizations like ESTEC and research institutions):

- Scientists with specialist knowledge of the GNSS-based occultation technique who wish to have software which can serve as a technique-related research support tool and a data processing tool.

- Scientists with basic knowledge of the GNSS-based occultation technique who wish to have a software to learn about the technique by performing standard runs and with data processing capability to get auxiliary data for their own work or techniques where they are specialists.

- Engineers, who in general may have basic occultation knowledge and who wish to have a software for supporting mission/constellation planning and performance evaluation of the entire system with particular interest in technical/instrumental effects as involved in the GNSS radio occultation technique.

The reader of this manual is thus expected to come from the scientific/technical community, to have at least a small basic knowledge of the radio occultation technique, and to be familiar with the use of software in a UNIX environment.

3.2 Applicability Statement

This manual covers version 4.0 of the EGOPS software.

For a detailed statement on the hardware and software requirements of EGOPS, please see the Section on “Installation Prerequisites” in Chapter 5.1, “EGOPS Installation Guidelines” of the EGOPS Software User Manual – Overview Manual [SUM-OV] (EGOPS4_SUM-OV.pdf).

3.3 How to Use this Manual

This is Part 2 of the Software User Manual [SUM], i.e. Software User Manual – Reference Manual [SUM-REF]. It contains information about all options within the EGOPS system including allowable ranges for input data, algorithms and techniques invoked when choosing different options, how to include user supplied data files etc. The reference manual is organized according to the logical work-flow when working with EGOPS. Each section corresponds to a main-level menu option. Each sub-section corresponds to one of the sub-options available.

3.4 Problem Reporting Instructions

Comments on the EGOPS system and the reporting of errors encountered during the use of the software package can be directed to:

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4 Project Menu

4.1 Launch New Project

4.1.1 Launch a New EGOPS Project

```
GENERAL DESCRIPTION

For creation of a new EGOPS Project, assign it an unique, not yet
existing, identifier. The length of this "Project-id" of the new EGOPS Project
is limited to a maximum of 25 characters (minimum length is one char).
The new EGOPS/Project-id should be an arbitrary alphanumeric string which
may also contain hyphen or underline characters. Longer strings, inter-
mediate blanks, or use of other characters are not allowed.


SPECIAL NOTES/HINTS

- Assign to your new EGOPS Project a "smart" Project-id which conveys some
  hint to you on what this Project is about. See it like choosing a good
  brief title for your project.


INPUT PARAMETER(S)

 1) === INPUT FIELD for assigning an EGOPS/Project-id ===

    Purpose:
       Allows to assign an EGOPS/Project-id to a new EGOPS Project
       by keyboard input.

    Type:
       Text input field for input of the EGOPS/Project-id.

    Format/Usage:
       Supply an arbitrary alphanumeric string of up to 25 characters which
       may also contain hyphen or underline characters. Longer strings,
       intermediate blanks, or use of other characters are not allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All strings which are compliant with the above defined format.
       The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
       'LetslearnEGOPS' are recognized as different). You will be
       properly warned in case you choose a EGOPS/Project-id which
       already exists from prior work or by default.

    Notes on Values:
       Hint - Avoid strings which may blame, annoy, seize up, etc., your
       colleague(s), who may potentially work with the same EGOPS...

    Availability/Indirect Effects:
       Always available. Remember that the EGOPS/Project-id will be the
       key name throughout the entire EGOPS system for identifying your
       current Project.


 2) === BUTTON/WINDOW for editing the new <Project-id>.log file ===

    Purpose:
       Allows to make some notices about your new EGOPS Project.

    Type:
       Pop-up Window which allows to write some notices about your new
```

```
       EGOPS/Project into a Text Editor field.

    Format/Usage:
       Press the button which causes a text editor field to pop-up. Put
       in your notices and save your input with "Save & Quit" to the
       protocol file <Project-id>.log or choose
       "Cancel" to return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available, as soon as a valid new EGOPS/Project-id was specified.


 3) === OK BUTTON (& Cancel Button) ===

    Purpose:
       Allows to confirm your new EGOPS/Project-id and closes the input
       window.

    Type:
       Button

    Format/Usage:
       Press the "OK" button to confirm your new EGOPS/Project-id or
       choose "Cancel" to return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if a valid new EGOPS/Project-id was specified.

INPUT EXAMPLE(S)

- Naming new EGOPS/Project-id to "LetsLearnEGOPS1":
   Set input field to 'LetsLearnEGOPS1'.
```

4.2 Open Project

4.2.1 Open EGOPS Project

```
GENERAL DESCRIPTION

Window for selecting an already existing EGOPS/Project-id. Selection
may be done by directly typing the EGOPS/Project-id name into the
foreseen input field or by means of the button/select-list window
("Existing EGOPS/Project-ids..." button).


SPECIAL NOTES/HINTS

- It is not possible to assign a new EGOPS Project-id via "Open ...",
  use the "Project - Launch new..." function for this purpose.


INPUT PARAMETER(S)

 1) === INPUT FIELD for assigning an Existing EGOPS/Project-id ===
```

```
   Purpose:
      Allows assignment of an existing EGOPS/Project-id by keyboard
      input.

   Type:
      Text input field for input of an Existing EGOPS/Project-id.

   Format/Usage:
      Put in the Existing EGOPS/Project-id string.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All already existing EGOPS/Project-ids.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


2) === BUTTON/SELECT-LIST for selecting an Existing EGOPS/Project-id ===

   Purpose:
      Allows to select an existing EGOPS/Project-id out of all existing
      ones.

   Type:
      Pop-up Window which allows to select by mouse-click an entry from a
      list of available entries.

   Format/Usage:
      Press the button which causes a select-list window to pop-up. Select
      by mouse-click an EGOPS/Project-id out of the available ones in the
      list (which is highlighted upon selection; note that always a default
      is already set). Confirm your selection with "OK" or choose "Cancel"
      to return without action.

   Range of Values:
      Any EGOPS/Project-id available in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


3) === BUTTON/WINDOW for editing the <Project-id>.log file ===

   Purpose:
      Allows to make some additional notices about your chosen
      EGOPS/Project.

   Type:
      Pop-up Window which allows to write some notices about your
      chosen EGOPS/Project into a Text Editor field.

   Format/Usage:
      Press the button which causes a text editor field to pop-up. Put
      in your notices and save your input with "Save & Quit" to the
      protocol file <Project-id>.log or choose
      "Cancel" to return without action.

   Range of Values:
      ---

   Notes on Values:
      ---
```

```
    Availability/Indirect Effects:
       Available after an existing EGOPS/Project-id was selected.


 4) === OK BUTTON (& Cancel button) ===

    Purpose:
       Allows to confirm your chosen EGOPS/Project-id and closes the input
       window.

    Type:
       Button

    Format/Usage:
       Press the "OK" button to confirm your selected EGOPS/Project-id or
       choose "Cancel" to return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available after an existing EGOPS/Project-id was selected.


INPUT EXAMPLE(S)

- Select existing EGOPS/Project-id 'LetsLearnEGOPS1':
   Set input field to 'LetsLearnEGOPS1', or select this Project-id by
   mouse-click employing the select-list window.
```

4.3 Close Project

4.3.1 Close EGOPS Project

```
GENERAL DESCRIPTION

Window for closing the currently open EGOPS Project.


SPECIAL NOTES/HINTS

- Only the currently open EGOPS Project can be closed.


INPUT PARAMETER(S)

 1) === FIELD showing the currently open EGOPS Project ===

    Purpose:
       In fact, this field allows no actual input (other than the corresponding
       fields of the "Launch new..." and "Open..." functions), i.e. the User
       cannot change the Project-id shown. The field shows the currently open
       EGOPS Project.

    Type:
       Text field (not editable).

    Format/Usage:
       ---

    Range of Values:
       Project-id of currently open EGOPS Project.

    Notes on Values:
```

```
      ---

   Availability/Indirect Effects:
      Always displayed.


 2) === BUTTON/WINDOW for editing the <Project-id>.log file ===

   Purpose:
      Allows to make some (additional) notices on the currently open
      EGOPS/Project.

   Type:
      Pop-up Window which allows to write some notices about the
      currently open EGOPS/Project into a Text Editor field.

   Format/Usage:
      Press the button which causes a text editor field to pop-up.
      Put in your notices and save your input with "Save & Quit" to
      the protocol file <Project-id>.log or choose "Cancel" to return
      without action.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


 3) === OK BUTTON (& Cancel Button) ===

   Purpose:
      Allows to confirm the closing of your chosen EGOPS Project and
      closes also the input window.

   Type:
      Button

   Format/Usage:
      Press the "OK" button to confirm closing the currently open
      EGOPS Project or choose "Cancel" to return without action.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


INPUT EXAMPLE(S)

- In order to close the project 'LetsLearnEGOPS1':
   Press the "OK" button.
```

4.4 Rename Project

4.4.1 Rename EGOPS Project

```
GENERAL DESCRIPTION

Window for renaming an already existing (old) EGOPS/Project-id to
a (new) EGOPS/Project-id.
Selection of the existing (old) EGOPS/Project-id can be done by
directly typing the old EGOPS/Project-id name into the foreseen
input field or by means of the button/select-list window
("Existing EGOPS/Project-ids..." button).
The new EGOPS/Project-id needs to be put in by keyboard into the
right input field.
The format conventions for EGOPS/Project-id strings apply also
to new EGOPS/Project-ids assigned here (cf. help on "Launch new...").


SPECIAL NOTES/HINTS

- Assign your new EGOPS Project a "smart" Project-id which conveys some
  hint to you on what this Project is about. See it like choosing a good
  brief title for your Project.
- If an EGOPS Project is currently open, its (old) EGOPS/Project-id
  is shown by default in the left input field.
- The "old" Project-id is renamed to the new one everywhere in the project-
  related file structure (project directory name, Project-id entries in
  the existing task input files, etc.). The exception is that it is not
  changed within the input file location info string in the header of the
  "old" task output data files.


INPUT PARAMETER(S)

 1,2) === INPUT FIELDS for specifying Old and New EGOPS/Project-id ===

    Purpose:
       Allows to specifiy Old and New EGOPS/Project-id by keyboard input.

    Type:
       Text input fields for input of Old and New EGOPS/Project-id.

    Format/Usage:
       Put in the Old and New EGOPS/Project-id.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All existing (old) EGOPS/Project-ids; for new EGOPS/Project-ids, all
       valid non-existing Project-id strings.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === BUTTON/SELECT-LIST for selecting an Existing EGOPS/Project-id ===

    Purpose:
       Allows to select an Existing User-defined (Old) EGOPS/Project-id.
       (User-defined means that the EGOPS-internal project "EGOPSProject" can
       of course not be renamed.)

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a
       list of available entries.
```

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse-click an existing EGOPS/Project-id out of the available ones in the list (which is highlighted upon selection; note that a default is already set). Confirm your selection with "OK" or choose "Cancel" to return without action.

Range of Values:
Any EGOPS/Project-id available in the list.

Notes on Values:

Availability/Indirect Effects:
Always available.

3) === BUTTON for editing the new Project's <Project-id>.log file ===

Purpose:
Allows to make some notices on your now renamed (new) EGOPS Project. Note that the old Project's <Project-id>.log will be carried over to the new <Project-id>.log file. Therefore the "old" notices on the Project are then present in the "new" <Project-id>.log file.

Type:
Pop-up Window which allows to write some notices about the renamed (new) EGOPS Project into a Text Editor field.

Format/Usage:
Press the button which causes a text editor field to pop-up. Put in your notices and save your input with "Save & Quit" to the new Project's protocol file <Project-id>.log or choose "Cancel" to return without action.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Available, as soon as a valid new EGOPS/Project-id was specified.

4) === OK BUTTON (& Cancel button) ===

Purpose:
Allows to confirm the new EGOPS/Project-id and closes the input window.

Type:
Button

Format/Usage:
Press the "OK" button to confirm your new EGOPS/Project-id or choose "Cancel" to return without action.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Available, as soon as a valid new EGOPS/Project-id was specified.

INPUT EXAMPLE(S)

```
- Rename 'LetsLearnEGOPS1' to 'EGOPS1TrainingExamples':
   Set Old EGOPS/Project-id input field to 'LetsLearnEGOPS1'
   (if "LetsLearnEGOPS1" is the currently open project this is set by default).
   Set New EGOPS/Project-id input field to 'EGOPS1TrainingExamples'.
   Confirm the renaming by pressing the "OK" button.
```

4.5 Delete Project

4.5.1 Delete EGOPS Project

```
GENERAL DESCRIPTION

Window for deleting an already existing EGOPS Project. Deleting
can be done by directly typing the EGOPS/Project-id name into the
foreseen input field or by means of the button/select-list window
("Existing EGOPS/Project-ids..." button).


SPECIAL NOTES/HINTS

- Be careful in using this function, since deletion of a project means
  that in fact every information (input/output data of all simulations
  performed within the project) including the project's directory structure
  is cleared from the disk.
- Trying to choose a non-existing EGOPS Project by direct keyboard input
  is inappropriate (and leads to an error message). Also, the EGOPS-internal
  basic project "EGOPSProject" is protected from deletion (attempts to
  delete it lead to an error message).


INPUT PARAMETER(S)

 1) === INPUT FIELD for deleting an existing EGOPS Project ===

    Purpose:
       Allows to delete an existing User-defined EGOPS Project by keyboard
       input. (User-defined means that the EGOPS-internal basic project
       "EGOPSProject" can of course not be deleted.)

    Type:
       Text input field for input of the existing EGOPS/Project-id string.

    Format/Usage:
       Put in the Existing EGOPS/Project-id string.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All already existing User-defined EGOPS/Project-ids.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === BUTTON/SELECT-LIST for deleting an existing EGOPS Project ===

    Purpose:
       Allows to delete an Existing EGOPS Project out of all existing
       User-defined ones.

    Type:
       Pop-up Window which allows to select by mouse-click an entry
       from a list of available entries.

    Format/Usage:
```

```
      Press the button which causes a select-list window to pop-up. Select
      by mouse-click an EGOPS/Project-id out of the available ones in the
      list (which is highlighted upon selection; note that a default
      is already set). Confirm your selection with "OK" or choose "Cancel"
      to return without action.

   Range of Values:
      Any EGOPS/Project-id available in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


 3) === OK BUTTON (& Cancel button) ===

   Purpose:
      Allows to delete your chosen EGOPS Project and closes the input
      window.

   Type:
      Button

   Format/Usage:
      Press the "OK" button to delete your selected EGOPS Project or
      choose "Cancel" to return without action. Pressing the "OK" button
      displays a last "Warning" message which informs you that *Every
      Information on this Project will be lost!*. If this is in fact o.k.,
      press the "OK" button of the "Warning" message, otherwise press
      "Cancel" to return to the "Delete"-window again.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Available only, if an existing EGOPS Project was selected.


INPUT EXAMPLE(S)

- Delete existing EGOPS/Project-id 'LetsLearnEGOPS1':
    Set input field to 'LetsLearnEGOPS1' and confirm (if "LetsLearnEGOPS1"
    is the currently open project this is set by default), then press
    the "OK" button of the "Delete" window and afterwards confirm with
    the "OK" button of the "Warning"-message window.
```

4.6 Shelve Project

4.6.1 Shelve EGOPS Project

```
GENERAL DESCRIPTION

Window for selecting an already existing EGOPS/Project-id for archiving.
Selection can be done by directly typing the EGOPS/Project-id name into
the foreseen input field or by means of the button/select-list window
("Existing EGOPS/Project-ids..." button). All data generated by EGOPS
in relation to the selected project will be stored automatically in
compressed form as ../EGOPS/projshelf/<Project-id>.tar.gz file.


SPECIAL NOTES/HINTS
```

```
- It is not allowed to choose a new EGOPS Project-id or to select the
  EGOPS default project (EGOPSProject) for archiving by direct keyboard
  input.


INPUT PARAMETER(S)

 1) === INPUT FIELD for assigning an Existing EGOPS/Project-id ===

    Purpose:
       Allows assignment of an existing EGOPS/Project-id by keyboard
       input.

    Type:
       Text input field for input of the Existing EGOPS/Project-id string.

    Format/Usage:
       Put in the Existing EGOPS/Project-id string.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All existing EGOPS/Project-ids, except EGOPSProject.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === BUTTON/SELECT-LIST for selecting an Existing EGOPS/Project-id ===

    Purpose:
       Allows to select an existing EGOPS/Project-id (except EGOPSProject).

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a
       list of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click an EGOPS/Project-id out of the available ones in the
       list (which is highlighted upon selection; note that always a default
       is already set). Confirm your selection with "OK" or choose "Cancel"
       to return without action.

    Range of Values:
       Any EGOPS/Project-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === BUTTON/WINDOW for editing the <Project-id>.log file ===

    Purpose:
       Allows to make some additional notices about your chosen
       EGOPS/Project.

    Type:
       Pop-up Window which allows to write some notices about your
       chosen EGOPS/Project into a Text Editor field.

    Format/Usage:
       Press the button which causes a text editor field to pop-up.
       Put in your notices and save your input with "Save & Quit"
       to the protocol file <Project-id>.log or choose "Cancel" to
       return without action.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available after an existing EGOPS/Project-id was selected.


 4) === OK BUTTON (& Cancel button) ===

    Purpose:
       Allows to confirm the EGOPS/Project-id for archiving and to close
       the input window.

    Type:
       Button

    Format/Usage:
       Press the "OK" button to confirm your selected EGOPS/Project-id
       or choose "Cancel" to return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available after an existing EGOPS/Project-id was selected.

INPUT EXAMPLE(S)

- Select existing EGOPS/Project-id 'LetsLearnEGOPS1' for archiving:
   Set input field to 'LetsLearnEGOPS1', or select this Project-id by
   mouse-click employing the select-list window.
```

4.7 Restore Project

4.7.1 Restore EGOPS Project

```
GENERAL DESCRIPTION

Window for selecting an already archived EGOPS/Project-id for restoring.
Selection can be done by directly typing the EGOPS/Project-id name into
the foreseen input field or by means of the button/select-list window
("Existing EGOPS/Project-ids..." button). All data generated by EGOPS
in relation to the selected project will be restored automatically in
the ../EGOPS/<Project-id> directory.


SPECIAL NOTES/HINTS

- It is not possible to change the EGOPS Project-id when restoring a
  project.


INPUT PARAMETER(S)

 1) === INPUT FIELD for assigning an Archived EGOPS/Project-id ===

    Purpose:
       Allows to specify of an archived EGOPS/Project-id by keyboard
       input.
```

```
    Type:
       Text input field for input of the archived EGOPS/Project-id.

    Format/Usage:
       Put in the archived EGOPS/Project-id.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All archived EGOPS/Project-ids.

    Notes on Values:
       ---

    Availability/Indirect Effects:
        Always available.


 2) === BUTTON/SELECT-LIST for selecting an Archived EGOPS/Project-id ===

    Purpose:
       Allows to select an archived EGOPS/Project-id.

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a
       list of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click an EGOPS/Project-id out of the available ones in the
       list (which is highlighted upon selection; note that always a default
       is already set). Confirm your selection with "OK" or choose "Cancel"
       to return without action.

    Range of Values:
       Any EGOPS/Project-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === OK BUTTON (& Cancel button) ===

    Purpose:
       Allows to confirm your selected EGOPS/Project-id for restoring and
       closes the input window.

    Type:
       Button

    Format/Usage:
       Press the "OK" button to confirm your selected EGOPS/Project-id
       or choose "Cancel" to return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available after an existing archived EGOPS/Project-id was selected.

INPUT EXAMPLE(S)

- Select existing EGOPS/Project-id 'LetsLearnEGOPS1' for restoring:
   Set input field to 'LetsLearnEGOPS1', or select this Project-id by
```

mouse-click employing the select-list window.

4.7.1.1 Restore EGOPS Project Warning

```
GENERAL DESCRIPTION

This Information Window gives a warning because the chosen EGOPS/Pro-
ject-id is already existing. To avoid any losses of data it is necessary
to rename the already existing project, otherwise (at least) parts of
the existing will be overwritten.  To avoid overwriting, close the warning
window with cancel and perform the appropriate steps before restoring this
EGOPS/Project-id again. The popup window allows to choose between deleting
the existing project and restoring the archived one or to overwrite the
existing project with the content of the stored EGOPS/Project-id.

SPECIAL NOTES/HINTS

-

INPUT PARAMETER(S)

 1) === CANCEL BUTTON ===

    Purpose:
       Allows to close the warning window without action.

    Type:
       Button

    Format/Usage:
       Press the "Cancel" button to close the warning window and
       return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === DELETE & RESTORE BUTTON  ===

    Purpose:
       Allows to delete the existing EGOPS/Project-id with the same
       name as the shelved EGOPS/Project-id selected and restores
       the latter one before closing the warning window.

    Type:
       Button

    Format/Usage:
       Press the "Delete & Restore" button to delete the existing
       EGOPS/Project-id with the same name as the shelved
       EGOPS/Project-id selected before restoring the latter one.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === UPDATE & RESTORE BUTTON  ===
```

```
    Purpose:
       Allows to overwrite the existing EGOPS/Project-id with the same
       name as the shelved EGOPS/Project-id selected for restoring.

    Type:
       Button

    Format/Usage:
       Press the "Update & Restore" button to overwrite the existing
       EGOPS/Project-id with the shelved EGOPS/Project-id selected
       for restoring.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Leave warning window without action:
   Press the 'Cancel' button to close the warning window without action.
```

4.8 Batchjobs Info

4.8.1 Batch Processing Information

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.5, titled "Batch Processing Information" .

4.8.2 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

4.8.3 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

4.8.4 Terminate Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

4.8.5 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

4.8.6 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

4.8.7 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

5 Task Menu

5.1 Mission Analysis/Planning

5.1.1 Mission Analysis Planning

GENERAL DESCRIPTION

Mission Analysis/Planning (MAnPl) is considered to include the analysis and planning of single LEO satellites and LEO constellations carrying GNSS occultation receivers, including antennae field-of-view planning and analysis and visibility analysis w.r.t. ground stations, for assessing, investigating, and optimizing occultation event coverage and related relevant statistics. Further included are reflection data calculation scenarios whereas the reflection geometry GNSS satellite - water surface (normally the ocean or several huge lakes) as big mirror for reflecting the GNSS radio signals to the LEO - LEO satellite can be analyzed.

Such analysis requires a considerable number of "free input parameters" in a simulation tool in order to allow for a (realistic) MAnPl simulation of widely arbitrary GNSS occultation missions. (See the section "MAnPl INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "MAnPl Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "MAnPl VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize MAnPl Statistics, Help on Visualize Geographic Maps" entries of the "Help" menu. Details are found in the On-line Help within the "Visualize Mission Analysis/Planning Statistics" and "Visualize Geographic Maps" interface windows available via the "Visualize/Validate" menu.)

MAnPl INPUT PARAMETERS

EGOPS allows to compute Mission Analysis/Planning tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Mission Analysis/Planning. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific MAnPl task.

The "MAnPl Input" window, available via the "Mission Analysis/Planning" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a few input file names, providing for access to some more lengthy parameter lists required, e.g., satellite orbit elements).

- Data type:
The selection between occultation- and reflection data is possible.

- Simulation time:
Start date and time, and the total time range for a simulation.

- Height levels of interest:
For each of such height levels (and for each occultation in the time range) the corresponding occultation geometry is computed, interpreting the height levels as those tangent point heights of an occultation event for which the geometric information is sought just at the instant when the levels are crossed. The essential geometric information is the corresponding geographic

coordinates of the tangent point together with the corresponding positions of the GNSS and LEO satellites involved in the occultation event. Height levels are only used for calculation of occultation data.

- Time step:
Choose an integer divide of the simulation time range for the reflection data time step. Time steps are only used for reflection data calculation.

- Geographic area of interest:
Global, hemispheric, or any regional area for which the coverage by occultation events is sought.

- GNSS-LEO/Reflection ray treatment:
Straight-line approximation of rays, or rays with quasi-realistic bending caused by the neutral atmosphere.

- Earth Figure model:
Spherical (R = 6371 km) or Ellipsoidal (WGS-84) Earth.

- Occultation/Reflection antennae specifications:
Antennae pointing and characteristics, including boresight direction and field-of-view width and shape, for "anti-velocity" looking and forward-looking antenna.

- Spaceborne receiver segment (LEO satellites):
Number and orbit constellation (i.e., orbit elements) of receiver platforms in LEO, and information on the LEO's zenith-antenna field-of-view.
This information is supplied by the leo*.tle files in the /orbitelem directory, one of which is always selected within the "MAnPl Input" window.
[Read the tle.Help file in the /orbitelem directory for more information on how to supply this information for LEOs.]

- LEO orbit propagator:
Spherical orbit approximation, Keplerian orbit, or "Simplified General Perturbation (SGP)" orbit (the latter including short and long period perturbations and parameterized atmospheric drag).

- Active space segment (GNSS):
Number and orbit constellation (i.e., orbit elements) of the GNSS transmitters.
Either GPS or GLONASS or both these GNSS systems are available for selection.
This information is supplied by the gps*.tle and glo*.tle files in the /orbitelem directory of EGOPS, which are selected within the "MAnPl Input" window.
[Read the tle.Help file in the /orbitelem directory for more information on how to supply this information for the GNSS.]

- GNSS orbit propagator:
Spherical orbit approximation, Keplerian orbit, or "Simplified General Perturbation (SGP)" orbit (the latter including short and long period perturbations and parameterized radiation/star drag).

- Ground segment (Fiducial and Tracking sites):
The number, location, and antenna field-of-view of auxiliary GNSS receiver sites for aiding the usual single- or double-difference processing of occultation data (fiducial sites), and the number, location, and antenna field-of-view of ground stations for telemetry/telecommand (tracking sites).
This information is supplied by fid*.gst and trk*.gst files, respectively, in the /groundst directory of EGOPS, which are selected within the "MAnPl input" window. [Read the gst.Help file in the /groundst directory for more information on how to supply this information on the sites.]
Satellite visibility information is then computed for the fiducial and tracking stations, as necessary for assessing the visibility conditions for single- and/or double-differencing and tracking for a given scenario.

MAnPl VISUALIZATION

EGOPS provides for the visualization of results of Mission Analysis/Planning tasks by its "Visualize MAnPl Statistics" and "Visualize Geographic Maps" window interfaces, both available through the "Visualize/Validate" menu.

The "MAnpl Statistics" interface allows to compute, visualize, and print-out 1D and 2D occultation coverage statistics as function of variables like latitude, Local Time, Duration of occultation Events, etc.
Furthermore, it allows to compute, visualize, and print-out visibility statistics for fiducial and tracking sites, e.g., no. of occultation events for which successful single- or double-differencing is possible by each of a given sample of fiducial sites, or no. of orbits seen for a certain time range per orbit by each of a couple of tracking sites.
[See "Help on Visualize/Val. - Help on Visualize MAnPl Statistics" for more information.]

The "Geographic Maps" interface allows to compute, visualize, and print-out latitude-longitude maps (different map projections available) of occultation event coverage for arbitrary geographic areas and including information such as on the geometrical shape and time of each event.
Furthermore, it allows to compute, visualize (stand-alone or as overplot to occultation event coverage maps), and print-out geographic maps of a series of atmospheric/ionospheric variables (e.g., temperature and electron density) from all atmospheric/ionospheric models available within EGOPS. These may either slice the atmospheric/ionospheric field at a certain height or be vertically integrated quantities (e.g., total precipitable water).
[See "Help on Visualize/Val. - Help on Visualize Geographic Maps" for more information.]

5.2 Mission Analysis/Planning Input

5.2.1 MAnPl/Task-Id

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task - About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)

The MAnPl/Task-id is the name and identification of the Mission Analysis/Planning (MAnPl) Task you are currently supplying the input for. It is the key identification means for EGOPS to separate all files relating to your current simulation activity (which will actually start when you go for Save&Compute in the bottom button row) from others with different inputs (which you will assign different Task-ids). In fact all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Mission/Analysis Planning will be saved in the /MAnPl subdirectory of the /<Project-id> directory of your current Project. (Consult the "Help on Project/About Projects" entry at the menu level in case you need to learn what an EGOPS "Project" and "Project-id" are.)

SPECIAL NOTES/HINTS

- Assign your Task a "smart" Task-id which conveys some hint to you on what this Task is about. See it like choosing a good brief title for your Task. (Among other things, this is very helpful during the visualization/validation of your results, when your primary selector will be just the Task-id assigned here.)

INPUT PARAMETER(S)

1) === INPUT FIELD for assigning a MAnPl/Task-id ===

   Purpose:
      Allows the assignment of a MAnPl/Task-id to your current Task by keyboard input.

   Type:

```
      Text input field for input of the Task-id string.

   Format/Usage:
      Supply an arbitrary alphanumeric string of up to 25 characters which
      may also contain hyphen or underline characters. Longer strings,
      intermediate blanks, or use of other characters are not allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All strings which are compliant with the above defined format.
      The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
      'LetslearnEGOPS' are recognized as different). You will be
      properly warned in case you choose a Task-id which already exists
      from prior work or by default.

   Notes on Values:
      Hint - Avoid strings which may blame, annoy, seize up, etc., your
      colleague(s), who may potentially work with the same EGOPS...

   Availability/Indirect Effects:
      Always available. Remember that the Task-id will be the key name
      throughout the entire EGOPS system for identifying your current Task.


2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing MAnPl/Task-id ===

   Purpose:
      Allows to select an existing Task-id out of all existing ones.
      (Most convenient in case a prior Task shall be re-run with only
      slight modifications, which is typically a very frequent case.)

   Type:
      Pop-up Window which allows to select by mouse-click a string entry
      from a list of available entries.

   Format/Usage:
      Press the button which causes a select-list window to pop-up. Select
      by mouse-click a Task-id out of the available ones in the list (which
      is highlighted upon selection; note that always a default is already
      set). Confirm your selection with "Ok" or choose "Cancel" to return
      without action.

   Range of Values:
      Any Task-id available in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Available only if more than one Task already exists (otherwise
      the only existing Task-id - MAnPldefault - is autom. set and the
      button/select-list window is insensitive).


3) ===  BUTTON/DELETE WINDOW for deleting existing MAnPl/Task-ids ===========

   Purpose:
      Allows to select one (or more) existing Task-id (s) out of all
      existing ones for deleting (only the MAnPldefault Task-id cannot
      be deleted). Specifically, all information relating to the chosen
      Mission/Analysis Planning Task-id (s) will be deleted in the /MAnPl
      subdirectory of the /<Project-id> directory of the currently open
      Project.

   Type:
      Pop-up Window which allows to select by mouse-click a string entry
      from a list of available entries for deleting.

   Format/Usage:
      Press the button which causes a special delete window to pop-up.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise
       the only existing Task-id - MAnPldefault - is not allowed to
       delete and the delete window button is set insensitive).
```

INPUT EXAMPLE(S)

```
- Naming one of a series of MAnPl Training Tasks:
   Set input field to 'LetsLearnEGOPS-3'
   (The button/select-list window need not be touched)

- Selecting an earlier Training Task of the above series:
   (The input field need not be touched)
   Select the Task-id 'LetsLearnEGOPS-2' by using the button/select-list window
```

5.2.2 Data Type Selection

GENERAL DESCRIPTION

This input allows to specify one of two different available Data Types for Mission Analyses/Planning. One option is to choose Occultation Data, the other one is to select Reflection Data as MAnPl Input.

SPECIAL NOTES/HINTS

- The Reflection Data mode only uses reflections from large water areas like big lakes or the ocean.

INPUT PARAMETER(S)

```
 1) === DROPLIST Data Type Selection Choice ===

    Purpose:
       Allows the selection between Occultation and Reflection Data.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Occultation Data', 'Reflection Data'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.
```

INPUT EXAMPLE(S)

```
- Selecting reflection data:
   Set droplist to 'Reflection Data'.
```

5.2.3 UT Range

GENERAL DESCRIPTION

This input group allows to specify the starting date/time of the simulations and the simulation time range. Therefore, the time range added to the start date/time gives the time of the end of the simulation.

SPECIAL NOTES/HINTS

- "Only" dates between 1990 and 2089 are supported.
- Minimum simulation time is 0000h 01min 00sec, i.e., 1 minute.
  Beware of further exploiting any MAnPl computation results in case of a short simulation time range, leading to no occultation events; in this case, re-run the simulation with a sufficiently long time range.
- Maximum simulation time is 999h 59min 59sec (about 6 weeks).
  A warning will be issued, if the orbital elements (i.e., the epoch) in the selected *.tle file are older than 6 month w.r.t. the simulation date. Prediction of LEO orbits with the "SGP (Impr. Kepler)" propagator might be significantly degraded, if the orbital elements are too old.
  For very low LEOs and long simulation time ranges, the satellite could even decay from orbit within the simulation time range. So, beware of being too far off from *.tle epoch times for accurate orbit prediction employing the SGP propagator.
  In case of "strange" abnormal termination of MAnPl computations (with a start date far off from the TLE-epoch), the reason could be that a satellite apparently has decayed. To confirm this assumption, rerun the task for a date close to the TLE-epoch. If the MAnPl computations then operate smoothly, the assumption is verified.
- Visibility Information on Differencing and Tracking is only available for a simulation time range longer than 3 hours.

INPUT PARAMETER(S)

1) === INPUT FIELD for input of Start Date/Time ===

Purpose:
Allows the input of the Simulation Start Date and Time by keyboard input.

Type:
Text input field for input of the Start Date/Time string.

Format/Usage:
Put in first the last two numbers of the chosen year, next two positions are reserved for the month followed by the number of the selected day. After a dot then enter the starting time beginning with the hours, then the minutes and seconds (in each case two digits are necessary for the correct input). Intermediate blanks are not allowed.
Press <CR> to deliver the input to the system.

Range of Values:
For the year from 90,...,99,00,01,...,89 (that means from 1990 till 2089), months from 01 (January) till 12 (December), and for the days the range depends on the chosen month (i.e. February 01 - 28 or 29, if it's a leap-year, October 01 - 31, and so on). Value ranges for hours are from 00 to 23 and for minutes and seconds are from 00 to 59.

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
Always available.

2) === INPUT FIELD for input of the Simulation Time Range ===

```
    Purpose:
       Allows the input of the Simulation Time Range by keyboard input.

    Type:
       Text input field for input of the Simulation Time Range string.

    Format/Usage:
       Put in first three digits for the chosen hour numbers, next two
       positions are reserved for the minutes, followed by the number
       of the seconds. Intermediate blanks are not allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Hours range from 000 to 999 and minutes and seconds range from
       00 to 59.

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting a Start Date/Time:
   If you want to start the simulation on the 13th June 2007 at 9h 43min
   and 6 sec, then set input field to '070613.094306'

- Selecting a Simulated Time Range:
   If you want to run the simulation for 23 hours 11 min and 37 sec, then
   set input field to '0231137'
```

5.2.4 Height Levels

```
GENERAL DESCRIPTION

This input field allows to specify the height levels for the Mission
Analysis/Planning simulation. Up to 4 different height level ranges can be
chosen. For each of these height levels, the corresponding occultation
geometry is computed, interpreting the height levels as those
tangent point heights of an occultation event, for which the geometric
information is requested at that instant the levels are passed.
Computed information includes, for each height level, all occultation
events in the selected time range, time, geographic location, GNSS and LEO
positions at the instant of height level crossings.


SPECIAL NOTES/HINTS

- An overlap of different height level ranges is not allowed.
- Choose the step size carefully to avoid unnecessary errors
  (the number of steps to cover a whole height level range
  has to be an integral number, i.e., the Hlo-Hhi bounds need
  be matched).


INPUT PARAMETER(S)

 1) === INPUT FIELD for Height Levels Definition ===

    Purpose:
       Allows to select as many as 4 independent height level ranges
       by directly specifying the desired height level values.

    Type:
       Text input field for the input of maximum 16 numbers for 4
       independent height level ranges.
```

Format/Usage:
Each value of a height level range can be specified with one post-comma digit and all values need be separated by a blank. For separation of the different height level ranges, a comma and a blank need be set (after the 4th value of a range). The first height level value is always the lower boundary of the height range interval (Hlo), the second is the upper boundary of the height range interval (Hhi), the third denotes the step size (Hstep), and the last one specifies the chosen accuracy for the simulation (dH). All units are in [km]. Press <CR> to deliver the input to the system.

Range of Values:
For later atmospheric calculations with FoMod and InRet, Hlo can be set between 0 km (earth surface) and 30 km, and Hhi can be set between 70 km and 120 km (for ionospheric calculations with FoMod or InRet, Hlo can be chosen between 0 km and 200 km, whereas Hhi can go up to the lowest perigee of the LEO-satellites contained in the current leo*.tle file). If only geometrical aspects are of interest, (pure MAnPl simulations) Hlo can be set between 0 km and Hhi, and Hhi can be chosen between Hlo and up to the lowest perigee of the LEO-satellites contained in the current leo*.tle file (if Hlo = Hhi is chosen, then the step size has to be set to 0, i.e. there is only one single height level). The minimum step size is 0.1 km and the maximum height accuracy dH of the simulation may be 0.05 km. The maximum noumber of height levels is 100.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Only available for data type 'Occultation Data'. If two adjacent ranges are chosen with different accuracy but common boundary (e.g., Hhi1=Hlo2), then the common boundary computations will use the more accurate dH value (e.g., MIN(dH1,dH2)).

INPUT EXAMPLE(S)

- Selecting one height level range:
  Select lower level = 0.0 km, upper level = 70.0 km, step size = 2.0 km, and accuracy = 0.2 km.
  Thus set the input field to '0 70 2 0.2'.

- Selecting two height level ranges:
  Select the same first range as in above example. For the second range, set 70.0 km for the lower level, 110.0 km for the upper boundary, 20.0 km as step size, and 2.0 km for the accuracy.
  Thus set the input field to '0 70 2 0.2, 70 110 20 2'.

5.2.5 Time Step

GENERAL DESCRIPTION

This input field allows to specify the length of the Time Step used for Mission Analysis/Planning Reflection Data calculation. The Simulation Time Range must at least contain two Time Step intervals. The computation has to be performed over a given Simulation Time Range with given Time Steps (in a given geographic region).

SPECIAL NOTES/HINTS

- The Time Step must always be an integer divide of the chosen Simulation Time Range (if this is not the case, the Simulation Time Range will be adjusted to the nearest possible value).

INPUT PARAMETER(S)

1) === INPUT FIELD for Time Step Definition ===

Purpose:
Allows to select the Time Step length.

Type:
Text input field for input of the Time Step.

Format/Usage:
Supply the numerical value with a maximum of one post-comma digit.
Press <CR> to deliver the input to the system.

Range of Values:
The minimum value for the Time Step is 0.1 [min]. The maximum value allowed is half the length of the chosen Simulation Time Range.
The default value for the Time Step is 5.0 [min].

Notes on Values:

Availability/Indirect Effects:
Only available for Data Type 'Reflection Data'.

INPUT EXAMPLE(S)

- Selecting a Time Step of 12.5 minutes:
  Set input field to '12.5'

5.2.6 Geographic Area of Interest for Occultation/Reflection Events

GENERAL DESCRIPTION

This input group allows to specify the geographic area for which occultation/reflection events shall be computed within the time range specified in the "UT Range" input group. For occultation events, only those events are accounted for in the MAnPl computations, whose tangent point (precisely speaking, the tangent point of the lowest height level specified in the "Height Levels" input) lies within the specified latitude-longitude region. Reflection events are computed for reflections from the surface of big lakes or from the oceans, but not from land areas.

SPECIAL NOTES/HINTS

- Specifying areas crossing the date line (+-180 deg) is no problem:
  Always observe that the minimum longitude (LoMin) is the westward longitude and the max. longitude (LoMax) is the eastward one.
  For example, LoMin = 160 and LoMax = -150 corresponds to a 50 deg wide longitude range crossing the date line.

INPUT PARAMETER(S)

1) === DROPLIST for Predefined Area Choice ===

Purpose:
Allows the selection of the most common predefined geographic areas by mouse-click or to select an arbitrary user-defined area.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

```
    Range of Values:
       One of the following 4 values: 'Global', 'Northern Hem.',
       'Southern Hem.', 'Regional...'

    Notes on Values:
       'Global' sets the geographic domain to span the entire globe.
       'Northern Hem.' sets the domain to the Northern Hemisphere.
       'Southern Hem.' selects the Southern Hemisphere.
       'Regional...' renders the input field for Arbitrary Area Definition
       sensitive and to allow selection of a user-defined area (see input
       parameter 2 below).

    Availability/Indirect Effects:
       The droplist is always available.

 2) === INPUT FIELD for Arbitrary Area Definition ===

    Purpose:
       Allows to select an arbitrary geogr. area by directly specifying the
       desired latitude-longitude region.

    Type:
       Text input field for input of the 4 numerical values for
       min/max latitude and min/max longitude.

    Format/Usage:
       Supply four numerical values with a maximum of one post-comma digit
       per value. Separate the individual values by at least one blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The first two values specify minimum and maximum latitude (LaMin LaMax)
       of the area, respectively, constrained by -90 <= LaMin,LaMax <= 90,
       with LaMax-LaMin >= 1 [deg].
       The other two values specify minimum and maximum longitude (LoMin LoMax)
       of the area, respectively, constrained by -180 <=LoMin,LoMax<= 180,
       with LoMax-LoMin >= 1 [deg].

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if the droplist for predefined area choice is set to
       'Regional...' (cf. parameter 1 above).


INPUT EXAMPLE(S)

- Selecting a global domain:
   Set droplist to 'Global'. The input field is then insensitive and
   automatically set to '-90.0 90.0 -180.0 180.0'
   (Note: Droplist 'Regional...' plus input field '-90 90 -180 180' would be
   a less convenient but formally valid alternative to set a global domain.)

- Selecting a regional domain covering Europe:
   Set droplist to 'Regional...'
   Set input field to '30 72 -30 60'
```

5.2.7 GNSS-LEO/Reflection Ray Treatment

GENERAL DESCRIPTION

In case of 'Occultation Data', this input allows to specify two different ways of GNSS-LEO Ray Treatment. The first one is an approximate computation assuming quasi-vacuum conditions, termed Straight Line Ray approximation, the second one is a more precise calculation, the Bended Ray approach.
The straight-line treatment determines the geometry of the occultation event for the desired height levels by assuming straight-line visibility between GNSS and LEO (i.e., vacuum or thin atmosphere). The bended-rays treatment

uses an exponential atmosphere model (very close to the RefAtm_UoG refractivity field included within EGOPS) and takes refractivity-field compliant bended-ray visibility into account. For 'Reflection Data', only the Straight Line Ray approximation is available.

SPECIAL NOTES/HINTS

- GNSS-LEO are acronyms for Global Navigation Satellite System - Low Earth Orbiting satellite.
- For quasi-realistic tropospheric geometries, the use of the bended-ray treatment is mandatory.

INPUT PARAMETER(S)

1) === DROPLIST for GNSS-LEO/Reflection Ray Treatment Choice ===

Purpose:
Allows the selection among Straight Line Rays and Bended Rays (for 'Occultation Data' and is fixed to Straight Line Rays for 'Reflection Data').

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry. The droplist-button always shows the current setting.

Range of Values:
One of the following 2 values: 'Straight Line Rays', 'Bended Rays (Exp. Atmos.)' in case of 'Occultation Data' or is fixed to Straight Line Rays for 'Reflection Data'.

Notes on Values:
'Straight Line Rays' treats the radio connection between GNSS and LEO as a straight line.
'Bended Rays (Exp. Atmos.)' selects bended rays as the more realistic path for radio signals between GNSS and LEO satellites under (near-)tropospheric conditions.

Availability/Indirect Effects:
The droplist is always available.

INPUT EXAMPLE(S)

- Selecting straight line rays:
  Set droplist to 'Straight Line Rays'

5.2.8 Earth Figure Model

GENERAL DESCRIPTION

In case of 'Occultation Data', this input allows to specify one of two different Earth Figure Models. The spherical Earth model assumes the Earth to be a sphere with constant mean radius 6371.0 km (the radius of a sphere with the same volume as the actual body of the Earth). The ellipsoidal Earth model follows the widely used WGS84 definition. This ellipsoid deviates from the mean-sea-level reference surface, the Geoid, by a maximum of no more than about 100 m. For 'Reflection Data' only the spherical Earth model is available for use.

SPECIAL NOTES/HINTS

- WGS84 is the acronym for World Geodetic System 1984.
- For a more rough approximation, one will typically choose the

```
  Spherical Earth model; when aiming for high absolute accuracy,
  the Ellipsoidal Earth model (WGS84) should be selected.


INPUT PARAMETER(S)

 1) === DROPLIST for Earth Figure Model Choice ===

    Purpose:
       Allows the selection between Spherical and Ellipsoidal (WGS84)
       Earth Figure Model for 'Occultation Data'. It is fixed to
       Spherical for 'Reflection Data'.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Spherical', 'Ellipsoidal (WGS84)'
       in case of 'Occultation Data'; it is fixed to 'Spherical' in case
       of 'Reflection Data'.

    Notes on Values:
       'Spherical' sets the Earth Figure to be a sphere.
       'Ellipsoidal (WGS84)' selects the WGS84 Ellipsoidal Earth model.

    Availability/Indirect Effects:
       The droplist is always available.


INPUT EXAMPLE(S)

- Selecting spherical earth figure:
   Set droplist to 'Spherical'.
```

5.2.9 GRAS/Reflection Antennae Specifications

```
GENERAL DESCRIPTION

Pressing of an antenna button opens a pop-up window. This pop-up
window allows to manipulate the technical antenna characteristics by
changing the values for the Boresight direction, the Antenna Field of View,
and the Threshold-Power Beam Width (TPBW).


SPECIAL NOTES/HINTS

- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".
- "-V antenna" denotes an antenna pointing towards the anti-velocity
  direction half-space of a satellite (backward viewing), "+V antenna"
  denotes pointing towards the velocity-direction half-space (forward
  viewing).
- "Threshold-Power Beam Width (TPBW)" denotes the  beamwidth about
  boresight within which the antenna is defined to have sufficient gain
  for acquiring an occultation event. A useful rule-of-thumb is to use
  the Half-Power Beam Width (HBPW) of an antenna as the TPBW (i.e.,
  applying the antenna's -3dB point as threshold).
- The small button at the left side allows to activate or to deactivate
  an Antenna for the simulations (leading, e.g., to setting occultation
  events only, in case no +V antenna is used).
- At least one antenna must be used.


INPUT PARAMETER(S)

 1) === BUTTONs for activating/opening Antenna Pop-up Window ===
```

```
    Purpose:
       The window allows to manipulate the technical antenna characteris-
       tics by changing the values for the Boresight direction, the Antenna
       Field of View, and the Threshold-Power Beam Width (TPBW).

    Type:
       2 buttons per antenna, the left one for activating or deactivating
       the opening-button and the right one for opening the Antenna Pop-up
       Window (if activated).

    Format/Usage:
       Press the left button (if desired) to activate an Antenna's pop-up
       window opening button, then press the opening-button to open the
       pop-up Window.

    Range of Values:
       One 2-button pair as described above for the "-V antenna"
       (enabling simulation of setting occ. events), one 2-button pair
       for the "+V antenna" (enabling simulation of rising occ. events).

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Pop-up Window opening button is only available when its
       corresponding activation button is pressed (i.e., in "On" position).


INPUT EXAMPLE(S)

- Activating '+V Antenna...' pop-up window:
   Press small left button to activate the '+V Antenna...' button, then
   click on the '+V Antenna...' button to open the +V Antenna Input pop-up
   window.
```

5.2.10 LEO(s) Orbit Element File

```
GENERAL DESCRIPTION

Pressing the LEO *.tle... button opens a Pop-up Window for the LEO-
*.tle-file selection.


SPECIAL NOTES/HINTS

- With this file selection tool, only leo*.tle-files can be chosen.
  To learn more what a *.tle file is and how to supply your own
  *.tle files, consult the file tle.Help located in the /orbitelem
  subdirectory of EGOPS.


INPUT PARAMETER(S)

 1) === BUTTON for opening file selection tool ===

    Purpose:
       This Pop-up Window allows to select a leo*.tle file from the
       /orbitelem subdirectory of EGOPS.

    Type:
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'LEO *.tle...' button to open the Pop-up Window.

    Range of Values:
       ---
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

```
- Activating the LEO orbital elements file selection tool:
   Press the 'LEO *.tle...' button.
```

5.2.11 LEO Orbit Model

GENERAL DESCRIPTION

This input allows to specify 3 different LEO Orbit Models. The simplest (but fastest) one is the Circular Orbits model, which is a reasonable approximation for near-circular orbits. For greater accuracy and elliptical orbits, the Keplerian Orbits model can be selected (the secular changes of the Kepler ellipse due to Earth's ellipsoidal mass distribution are included here). The most accurate and realistic LEO Orbits available are SGP Orbits (Improved Kepler orbits). SGP orbits also include short and long period perturbations to the Kepler ellipse and a parametric treatment of atmospheric drag or star drag.

SPECIAL NOTES/HINTS

```
- LEO is the acronym for Low Earth Orbiting satellites.
- SGP is the name of the 'SGP' satellite orbit propagator, which is
  one of the official propagators to propagate the NORAD/NASA
  two-line orbital elements (*.tle files; see the tle.Help file
  in the /orbitelem directory of EGOPS for more information on this).
```

INPUT PARAMETER(S)

```
 1) === Droplist for LEO Orbit Model Choice ===

    Purpose:
       Allows the selection among Circular Orbits, Keplerian Orbits,
       and SGP Orbits (Improved Kepler).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Circular Orbits', 'Keplerian
       Orbits', or 'SGP Orbits (Impr. Kepler)'.

    Notes on Values:
       'Circular Orbits': circular LEO orbits can be calculated with
       this model (eccentricity in the *.tle files is ignored).
       'Keplerian Orbits': allows to calculate circular and elliptic LEO
       orbit models.
       'SGP Orbits (Impr. Kepler)': based on a Keplerian Orbit model,
       but takes into account higher order perturbations and drag effects
       for improving the orbit model accuracy.

    Availability/Indirect Effects:
       The droplist is always available.
```

INPUT EXAMPLE(S)

```
- Selecting Keplerian Orbits:
   Set droplist to 'Keplerian Orbits'
```

5.2.12 GNSS Satellite System

```
GENERAL DESCRIPTION

This input group allows to choose between two different GNSS Satellite
Systems, the US GPS and the Russian GLONASS.
At least one system must be used for mission analyses/planning, but
both systems may be used the same time, too.
These satellites systems are the active space segment used by the
occultation technique.


SPECIAL NOTES/HINTS

- GNSS is the generic acronym for the Global Navigation Satellite System
  (comprising the two existing systems GPS and GLONASS).
- GPS is the US Global Positioning System.
- GLONASS is the Russian GLObal NAvigation Satellite System.


INPUT PARAMETER(S)

 1) === DROPLIST for GPS Choice ===

    Purpose:
       Allows to select between GPS/standard and GPS/none.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values: 'GPS/standard', 'GPS/none'.

    Notes on Values:
       'GPS/standard' means that the whole nominal 24 GPS-satellite
       constellation will be used for simulations if properly flagged in
       the gps*.tle file (see the tle.Help file in the /orbitelem directory
       of EGOPS for more information).
       'GPS/none': switch off the use of GPS.

    Availability/Indirect Effects:
       The droplist is basically always available. However,
       at least one system (GPS or GLONASS) must be used.


 2) === DROPLIST for GLONASS Choice ===

    Purpose:
       Allows to select between GLON/standard and GLON/none.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values: 'GLON/standard', 'GLON/none'.

    Notes on Values:
```

```
       'GLON/standard' means that the whole nominal 24 GLONASS-satellite
       constellation will be used for simulations (if properly flagged
       in the glo*.tle file; see the tle.Help file in the /orbitelem
       directory of EGOPS for more information).
       'GLON/none': switch off the use of GLONASS.

    Availability/Indirect Effects:
       The droplist is basically always available. However,
       at least one system (GPS or GLONASS) must be used.


INPUT EXAMPLE(S)

- Selecting both GPS and GLONASS:
   Set droplists to 'GPS/standard' and 'GLON/standard', respectively.
```

5.2.13 GNSS Orbit Element File

```
GENERAL DESCRIPTION

Pressing the 'GPS *.tle...' or 'GLON *.tle...' button opens a Pop-up Window
for the gps*.tle or glo*.tle file selection.


SPECIAL NOTES/HINTS

- With this file selection tool, only gps*.tle- or glo*.tle files can be
  chosen. To learn more what a *.tle file is and how to supply your own
  *.tle files, consult the file tle.Help located in the /orbitelem
  subdirectory of EGOPS.


INPUT PARAMETER(S)

 1) === BUTTON for opening GPS *.tle file selection tool ===

    Purpose:
       This Pop-up Window allows the selection of a gps*.tle file from the
       /orbitelem subdirectory of EGOPS.

    Type:
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'GPS *.tle...' button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available if the GNSS Satellite System droplist is not in the
       position 'GPS/None'.


 2) === BUTTON for opening GLON *.tle file selection tool ===

    Purpose:
       This Pop-up Window allows the selection of a desired glo*.tle
       file from the /orbitelem subdirectory of EGOPS.

    Type:
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'GLON *.tle...' button to open the Pop-up Window.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available, if the GNSS Satellite System droplist is not in the
       position 'GLON/None'.


INPUT EXAMPLE(S)

- Activating the GPS *.tle file selection tool:
   Press the 'GPS *.tle...' button.
```

5.2.14 GNSS Orbit Model

GENERAL DESCRIPTION

This input allows to specify 3 different GNSS Orbit Models. The simplest (but fastest) one is the Circular Orbits model which is often a reasonable approximation for near-circular orbits (as GPS ones). For greater accuracy and elliptical orbits, the Keplerian Orbits model can be selected (the secular changes of the Kepler ellipse due to Earth's ellipsoidal mass distribution are included here). The most accurate and realistic GNSS Orbits available are SGP Orbits (Improved Kepler orbits). SGP orbits also include short and long period perturbations of the Kepler ellipse and a parametric treatment of atmospheric drag or star drag.

SPECIAL NOTES/HINTS

- GNSS is the acronym for Global Navigation Satellite System (currently consisting of GPS and GLONASS).
- SGP is the name of the 'SGP' satellite orbit propagator which is one of the official propagators to propagate the NORAD/NASA two-line orbital elements (*.tle files; see the tle.Help file in the /orbitelem directory of EGOPS for more information on this).

INPUT PARAMETER(S)

```
 1) === DROPLIST for GNSS Orbit Model Choice ===

    Purpose:
       Allows the selection among Circular Orbits, Keplerian Orbits,
       and SGP Orbits (Improved Kepler).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Circular Orbits', 'Keplerian
       Orbits', or 'SGP Orbits (Impr. Kepler)'.

    Notes on Values:
       'Circular Orbits': circular GNSS orbits can be calculated with
       this model (eccentricity in the *.tle files is ignored).
       'Keplerian Orbits': allows to calculate circular and elliptic GNSS
       orbit models.
       'SGP Orbits (Impr. Kepler)': based on a Keplerian Orbit model,
       but takes into account higher order perturbations and drag effects
       for improving the orbit model accuracy.
```

```
    Availability/Indirect Effects:
       The droplist is always available.
```

INPUT EXAMPLE(S)

```
- Selecting Circular Orbits:
   Set droplist to 'Circular Orbits'
```

5.2.15 Visibility Information on Differencing

GENERAL DESCRIPTION

Setting the droplist button to 'Differencing Vis. Info...' opens a Pop-up Window for the Visibility Information on Differencing input. This Pop-up Window allows to select among different Differencing Visibility Choices and different Fiducial Sites by pressing the corresponding buttons.
To deactivate these functions, set the droplist button to 'No Differencing Vis. Info'. The droplist is only available for 'Occultation Data', if the simulation time range is longer than 3 hours.

SPECIAL NOTES/HINTS

- If the droplist shows 'Differencing Vis. Info...' and the Pop-up Window is already closed, it is most conveniently opened again by double clicking on 'Differencing Vis. Info...'.
- If this function is enabled, you can later on derive statistics on how well your fiducial sites will be able to help in "Double Differencing" or "Ground-based Single Differencing" processing of your occultation data. Consider not to use this function, if it is not relevant for the current Task or if the topic does not say much to you; this will increase the speed of the MAnPl computations considerably (and save disk space).
- In order to learn more about how to specify fiducial sites via fid*.gst files, consult the file gst.Help in the /groundst directory of EGOPS.

INPUT PARAMETER(S)

```
 1) === BUTTON for opening Differencing Vis. Info. Input Pop-up Window ===

    Purpose:
       The window allows to select various Differencing Visibility
       Choices and a corresponding Fiducial Site fid*.gst file.

    Type:
       Droplist with two different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       'No Differencing Vis. Info', 'Differencing Vis. Info...'.

    Notes on Values:
       'Differencing Vis. Info...' opens the Pop-up Window for the
       Differencing Visibility Information Input.
       'No Differencing Vis. Info' switches off the use of the
       Differencing Vis. Information capability.

    Availability/Indirect Effects:
       The droplist is only available for 'Occultation Data', if the
       simulation time range is longer than 3 hours. The Pop-up Window
       is available, if the droplist shows 'Differencing Vis. Info...'.
```

INPUT EXAMPLE(S)

- Activating Differencing Visibility Information Input Pop-up Window:
  Set droplist to 'Differencing Vis. Info...'.

5.2.16 Visibility Information on Tracking

GENERAL DESCRIPTION

Setting the droplist button to 'Tracking Vis. Info...' opens a Pop-up Window for the Visibility Information on Tracking Input. This Pop-up Window allows to select between different Tracking Station(s) trk*.gst files. To deactivate this function, set the droplist button to 'No Tracking Vis. Info'. The droplist is only available for 'Occultation Data', if the simulation time range is longer than 3 hours.

SPECIAL NOTES/HINTS

- If the droplist shows 'Tracking Vis. Info...' and the Pop-up Window is already closed, it is most conveniently opened again by double clicking on 'Tracking Vis. Info...'.
- If this function is enabled, you can later on derive statistics on how many orbits of the simulated LEOs have been seen by the selected tracking sites. This is done within the "Visualize MAnPl Statistics" menu item of the "Visualize/Validate" menu.
- In order to learn more on how to specify tracking stations via trk*.gst files, consult the file gst.Help in the /groundst directory of EGOPS.

INPUT PARAMETER(S)

1) === BUTTON for opening Tracking Vis. Info. Input Pop-up Window ===

Purpose:
This window allows to select a Tracking Station trk*.gst file.

Type:
User I/F: Droplist with two different entries available for selection.
Internally: Unique String variable for each droplist entry.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
'No Tracking Vis. Info', 'Tracking Vis. Info...'.

Notes on Values:
'Tracking Vis. Info...' opens the Pop-up Window for the Tracking Visibility Information Input.
'No Tracking Vis. Info' switches off use of the Tracking Visibility Information capability.

Availability/Indirect Effects:
The droplist is only available for 'Occultation Data', if the simulation time range is longer than 3 hours. The Pop-up Window is available, if the droplist shows 'Tracking Vis. Info...'.

INPUT EXAMPLE(S)

- Activating Tracking Visibility Information Input Pop-up Window:
  Set droplist to 'Tracking Vis. Info...'.

5.2.17 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.2.18 Save & Compute

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.3, titled "Save & Compute" .

5.2.19 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

5.2.20 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

5.2.21 Save Input

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.4, titled "Save Input" .

5.2.22 Input Summary

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.3.1, titled "Input Summary" .

5.2.23 Delete MAnPl-Tasks Input

5.2.23.1 Delete Task-Ids

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.5.1, titled "Delete Task-Ids" .

5.2.24 Antenna Input

5.2.24.1 Boresight

```
GENERAL DESCRIPTION

This input group allows to specify the Elevation and the Azimuth of the
GRAS/Reflection antenna mounted on the LEO relative to the antenna coordinate
system. The antenna coordinate system is a s/c (spacecraft) fixed
cartesian system, having its Z axis pointing towards nadir, its X axis
perpendicular to this Z axis in the plane spanned by the s/c velocity vector
```

```
and the Z axis, and the Y axis completing a right-handed coordinate system.


SPECIAL NOTES/HINTS

- Note that an Elevation of 0 deg denotes an antenna boresight in the X-Y
  plane in antenna coordinates, the elevation increasing downwards (towards
  nadir, i.e. Z-Axis).
- An Azimuth of 0 deg means a forward-looking, an Azimuth of 180 deg
  a backward-looking antenna, the azimuth increasing from X over Y.
- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".


INPUT PARAMETER(S)

 1) === INPUT FIELD for Elevation ===

    Purpose:
       Allows the input of the antenna boresight Elevation by
       keyboard input.

    Type:
       Text input field for input of the Elevation value.

    Format/Usage:
       Put in the numbers for the chosen Elevation with a maximum
       of one post-comma digit.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Elevation, 0 to 60 deg (default 27.0 deg, approx. towards Earth limb
                  for a typical LEO near 800 km).

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for Azimuth ===

    Purpose:
       Allows the input of the antenna boresight Azimuth by
       keyboard input.

    Type:
       Text input field for input of the Azimuth value.

    Format/Usage:
       Put in the numbers for the chosen Azimuth with a maximum
       of one post-comma digit.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Azimuth, 90 to 270 deg for the "-V antenna" (default 0 deg),
               -90 to 90 deg for the "+V antenna" (default 180 deg).

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting an Elevation input of 27.7 deg:
   Set Elevation input field to '27.7'.
```

5.2.24.2 Antenna Field of View

```
GENERAL DESCRIPTION

This input allows to select among different Antenna field-of-views (FOVs).
It is possible to select a Conical FOV, an Elliptical FOV/horizontally
Cartesian, or an Elliptical FOV/horizontally Earth shaped.
"Conical FOV" means that any power pattern isocontour of the antenna main lobe
corresponds to a circle so the FOV defined by this isocontour is a cone with
constant opening angle at all lobe azimuths. In short, the lobe is cone-shaped.
"Elliptical FOV/horiz. Cartesian" means that the lobe's isocontours are
(regular) ellipses corresponding to an elliptical lobe shape with different
opening angles in the horizontal and vertical. The term "horiz. Cartesian" is
added to distinguish this regular ellipse-shape from another shape called
"Elliptical FOV/horiz. Earth-shaped", which means a quasi-ellipse with the
horizontal axis distorted to follow the shape of the Earth surface as seen from
the LEO satellite.


SPECIAL NOTES/HINTS

- The "Elliptical FOV/horizontally Earth" shaped antenna FOV is not
  available for reflection data calculations.


INPUT PARAMETER(S)

 1) === DROPLIST for Antenna FOV ===

    Purpose:
       Allows to select between Conical- and two types of Elliptical
       Field of View (horizontally Cartesian and horiz. Earth shaped).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       In case of 'Occultation Data', one of the following three values:
       'Conical FOV', 'Ellip. FOV/hor. Cartesian', 'Ellip. FOV/hor. Earth
       shaped'.
       In case of 'Reflection Data', one of the following two values:
       'Conical FOV', 'Ellip. FOV/hor. Cartesian'.

    Notes on Values:
       'Conical FOV', antenna lobe of conical/circular shape.
       'Ellip. FOV/hor. Cartesian', antenna lobe of elliptical shape.
       'Ellip. FOV/hor. Earth shaped', antenna lobe
       (quasi-ellipse with the horizontal axis distorted to follow
       the shape of the Earth surface as seen from the LEO).

    Availability/Indirect Effects:
       The droplist is always available.


INPUT EXAMPLE(S)

- Selecting conical field of view:
   Set droplist to 'Conical FOV'.
```

5.2.24.3 Threshold-Power Beam Width

```
GENERAL DESCRIPTION

This input group allows to specify the Horizontal- and Vertical Threshold-
```

```
Power Beam Width of a GRAS/Reflection antenna mounted on the LEO(s).
The Horizontal/Vertical Threshold-Power Beam Width (TPBW) is that antenna
beamwidth in Horizontal/Vertical direction, at which a predefined gain is
reached, sufficient for for acquiring occultation measurements.
A good rule-of-thumb is to take the half-power beamwidth (HPBW) of an
antenna (corresponding to a -3dB threshold of the normalized power pattern)
as the value for the TPBW.


SPECIAL NOTES/HINTS

- For the Conical FOV,  for which any Threshold-Power contour is a circle,
  only one TPBW input is necessary (horizontal TPBW = vertical TPBW).
- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".


INPUT PARAMETER(S)

1,2) === INPUT FIELDS for setting the Threshold-Power Beam Widths ===

    Purpose:
       Allows to select the Horizontal and Vertical Threshold-Power
       Beam Width (in two separate input fields) by keyboard input.

    Type:
       Text input fields for input of the Horizontal/Vertical
       Threshold-Power Beam Width values.

    Format/Usage:
       Put in the numbers for the chosen Threshold-Power Beam Width
       with a maximum of one post-comma digit.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Horizontal/Vertical Threshold-Power Beam Width (TPBW), 1.0 to
       180.0 deg for 'Conical FOV' and 'Ellip. FOV/hor. Cartesian'
       (default is 90.0 deg in all 3 options). For 'Ellip. FOV/hor.
       Earth shaped', the Horizontal TPBW range is the same as above,
       the maximum Vertical TPBW is confined to half of the chosen
       Horizontal TPBW, and the minimum Vertical TPBW depends on the
       Horizontal TPBW (i.e. 1 deg for a Horizontal TPBW of 1 deg,
       10 deg for a Horizontal TPBW of 90 deg and 30 deg for a Horizontal
       TPBW of 180 deg; cf. two linear functions with different derivatives
       between 1 and 90 deg and 90 to 180 deg define the lower limit
       for the Vertical TPBW).

    Notes on Values:
       Only numbers are allowed.
       The values define the full width of the beam (e.g., 90 deg = +-45
       deg about boresight).

    Availability/Indirect Effects:
       Horizontal TPBW input field is always available; vertical TPBW input
       field is insensitive in case of Conical FOV
       (i.e. the horizontal TPBW is equal to the vertical TPBW).


INPUT EXAMPLE(S)

- Selecting 120 deg as horizontal TPBW input:
   Set Horizontal TPBW input field to '120'.
```

5.2.24.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.2.25 Two Line Element File Selection Input

5.2.25.1 LEO.tle...*

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.25.2 GPS.tle...*

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.25.3 GLON.tle...*

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.26 Differencing Visibility Informations Input

5.2.26.1 Differencing Visibility Choices

```
GENERAL DESCRIPTION

This input group allows to select Double Differencing Info and/or Ground-
based- and/or Space-based Single Differencing Info. Visibility information,
generated by the MAnPl computations, may be later evaluated with the
"Visualize MAnPl Statistics" tool's Differencing Visibility Statistics option.


SPECIAL NOTES/HINTS

- Either one of the three offered Differencing treatments is selected, or
  you dismiss the window and choose 'No Differencing Vis. Info'.


INPUT PARAMETER(S)

 1) === BUTTON for Double Differencing Info ===

    Purpose:
       To activate or deactivate Double Differencing Info.

    Type:
       Button (on/off toggle).

    Format/Usage:
       Click button for (de)activating 'Doub.-Diff. Info'.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === BUTTON for Ground-based Single Differencing Info ===
```

```
    Purpose:
       To activate(deactivate) Ground based Single Differencing Info.

    Type:
       Button (on/off toggle).

    Format/Usage:
       Click button for (de)activating 'Gnd.-b. Sing.-Diff. Info'.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === BUTTON for Space-based Single Differencing Info ===

    Purpose:
       To activate(deactivate) Space-based Single Differencing Info.

    Type:
       Button (on/off toggle).

    Format/Usage:
       Click button for (de)activating 'Spaceb. Sing.-Diff. Info'.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Activate Double Differencing Info when deactivated:
   Press 'Doub.-Diff. Info' button.
```

5.2.26.2 Fiducial Sites File

```
GENERAL DESCRIPTION

Pressing the 'Fiducial Sites fid*.gst...' button opens a Pop-up Window
for the Fiducial Sites *.gst-file selection.


SPECIAL NOTES/HINTS

- With this file selection tool only fid*.gst-files can be chosen.
  (TLE-files reside in the /groundst subdirectory of EGOPS; see the
  file gst.Help in the same directory for more information.)


INPUT PARAMETER(S)

 1) === BUTTON for opening file selection tool ===

    Purpose:
       The Pop-up Window allows to select a fid*.gst file from the
       /groundst directory of EGOPS.

    Type:
```

```
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'Fiducial Sites fid*.gst...' button to open the
       Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available, if the 'Doub.-Diff. Info' and/or the 'Gnd.-b.
       Sing.-Diff. Info' button was activated before.
```

INPUT EXAMPLE(S)

```
- Activating the file selection tool:
   Press the 'Fiducial Sites fid*.gst...' button.
```

5.2.26.3 Additional LEOS File

GENERAL DESCRIPTION

Pressing the 'Additional leo*.tle file...' button opens a Pop-up Window for the Additional leo*.tle-file selection. Additional leo*.tle-files are only necessary for Space-based Single Differencing.

SPECIAL NOTES/HINTS

- With this file selection tool, only leo*.tle-files can be chosen. (TLE-files reside in the /orbitelem subdirectory of EGOPS; see the file tle.Help in the same directory for more information.)

INPUT PARAMETER(S)

```
 1) === BUTTON for opening file selection tool ===

    Purpose:
       The Pop-up Window allows to select an additional leo*.tle file
       from the /orbitelem directory of EGOPS.

    Type:
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'Additional leo*.tle file...' button to open the
       Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available, if the 'Space-based Single Differencing Info'
       button was activated before.
```

INPUT EXAMPLE(S)

```
- Activating the additional LEO orbital elements file selection tool:
   Press the 'Additional leo*.tle file...' button.
```

5.2.26.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.2.26.5 Fiducial Sites File Selection Input

5.2.26.5.1 Fiducial Sites fid*.gst File...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.26.6 Additional LEOS File Selection Input

5.2.26.6.1 Additional leo*.tle File...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.27 Tracking Visibility Information Input

5.2.27.1 Tracking Visibility Choices

```
DESCRIPTION

Ground to LEO Tracking Info is currently the single fixed option. (So no
actual choice is available but the input is designed to be readily expandable
for add-on choices).
The displayed framed Label "Ground to LEO Tracking Info" is to highlight
this currently fixed option.
```

5.2.27.2 Tracking Station Filename

```
GENERAL DESCRIPTION

Pressing the 'Tracking Station(s) trk*.gst...' button opens a Pop-up Window
for the Tracking Station(s) *.gst-file selection.


SPECIAL NOTES/HINTS

- With this file selection tool, trk*.gst-files can be chosen from the
  /groundst subdirectory of EGOPS. See the file gst.Help in the same
  directory for more information.


INPUT PARAMETER(S)

 1) === BUTTON for opening file selection tool ===

    Purpose:
       The Pop-up Window allows to select the trk*.gst file from the
       /groundst directory of EGOPS.
```

```
    Type:
       Button for activating the file selection tool.

    Format/Usage:
       Press the 'Tracking Station(s) trk*.gst...' button to open the
       Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Activating the file selection tool:
   Press the 'Tracking Station(s) trk*.gst...' button.
```

5.2.27.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.2.27.4 Tracking Station Selection Input

5.2.27.4.1 Tracking Station(s) trk*.gst File...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.2.28 Batch Job Input

5.2.28.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

5.2.28.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.2.28.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

5.2.29 Batch Processing Information

5.2.29.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.2.29.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

5.2.29.3 Terminate Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

5.2.29.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

5.2.29.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

5.2.29.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

5.3 Forward Modeling

5.3.1 Forward Modeling

```
GENERAL DESCRIPTION

Forward Modeling (FoMod), together with subsequent Observation System
Modeling (OSMod), performs quasi-realistic simulation of observables, and
related required variables, of the GNSS occultation technique. The main
observables are time-tagged phase and amplitude measurements, obtained in
real world by tracking occulted GNSS signals with a LEO platform-mounted
GNSS receiver for atmospheric sounding (GRAS) during their set/rise
through the atmosphere imposed by the relative orbital motion of the GNSS
and LEO satellites.

Forward Modeling itself denotes the simulation of GNSS signal propagation
through the atmosphere/ionosphere system given the orbital motions of the
GNSS and LEO satellites. It results in "ideal" signals which contain the
effects of the atmosphere/ionosphere media only. - "Ideal" in the sense
that it is the state of the signal right before it enters the receiving
```

antenna and before any degradations by the receiving system are incurred. Thus FoMod results allow to inspect the environmental influence alone. In addition to spaceborne radio occultations (GNSS-LEO) EGOPS allows also to simulate airborne occultations (GNSS-Airplane) where the GRAS receiver is placed onboard an aircraft instead of a LEO satellite.

Furthermore, it is quite useful in terms of computational performance to separate FoMod, involving CPU-expensive propagation simulation (i.e., ray tracing) from OSMod, since the latter can be treated very efficiently as superposition of "observation system" effects on the "ideal" signal. Thus studies of different receiving system effects can be efficiently carried out using one and the same CPU-expensive FoMod results as baseline. [See "Help on Task - Help on Observation System Modeling" for more information on OSMod.]

In case of interest in observation simulations, Forward Modeling is the natural stage in EGOPS following some planning and preparation of occultation events with desired properties within "Mission Analysis/Planning (MAnPl)" (e.g., events occurring in a geographic region of interest, etc.). In fact the geometric properties (i.e., LEO and GNSS orbital arcs) of an occultation event being "forward modeled" can be, in case simulations are desired for realistic geometry, directly taken from the results of a User-selected MAnPl task (typically prepared before). For a realistic airborne occultation the mission analysis and planning part will be additionally done together with the rest of the pure forward modelling tasks in FoMod.

Such forward modelling requires a considerable number of "free input parameters" in a simulation tool in order to allow for a (realistic) FoMod simulation of widely arbitrary GNSS occultation missions. (See the section "FoMod INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "FoMod Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and validation of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "FoMod VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize/Val. Profiles" entry of the "Help" menu. Details are found in the On-line Help within the "Visualize/Validate Profiles" interface window available via the "Visualize/Validate" menu.)

FoMod INPUT PARAMETERS

EGOPS allows to compute Forward Modeling tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Forward Modeling. Nomen est omen all these parameters can be - within their range of validity - freely set by the User just as desired for a specific FoMod task.
The "FoMod Input" window, available via the "Forward Modeling" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a "Reference MAnPl Task-id" in case simulations are desired for realistic geometry, providing for access to the input conditions and results of a prior MAnPl task).

- Type of occultation event to be simulated:
For spaceborne radio occultations a single event or a whole sample of events can be "forward modeled", whereby single events can be simulated either for an ideal geometry (assuming co-planar GNSS and LEO orbits and, correspondingly, virtually-vertical tangent point trajectory) or for a realistic geometry (based on the geometry data obtained for a result event of a prior MAnPl task). Sample-of-event simulations always require event samples from a prior MAnPl task. Approximately the same is true for airborne radio occultations (only sample of realistic airborne occultation events cannot be processed).

   - Specifications for modelling a single event with ideal geometry:

Tangent point location, azimuth of occultation plane (containing GNSS, LEO, and the Earth's center), start date and time, GNSS and LEO orbital heights, and height range over which the occultation event shall be "forward modeled". In case of an ideal geometry airborne occultation all LEO specs are substituted by their corresponding aircraft specs (additionally also the speed of the airplane is needed as input parameter).

- Specifications for modeling with realistic geometry:
Reference MAnPl Task-id (to be selected from the list of suitable MAnPl tasks existing within the current Project), event number of desired event within the MAnPl results (if single event) or event number range within the MAnPl results (if sample of events), and height range over which the event(s) shall be "forward modeled". In case of an airborne occultation with realistic geometry the coordinates of the start and end location, the GNSS orbit element file, the start date and time, the airplane height and speed, the occultation event height range and the occultation event number are the key input parameters.

- Choice of atmospheric and ionospheric models:

  - Climatological atmospheric model: No atmosphere, or simple dry or moist (bi-)exponential atmosphere, or dry 3D atmosphere, or dry or moist 2D atmosphere, or the GSM 3D Atmosphere, or the HiVRes Atmosphere, or a user-supplied atmosphere (default for the latter: the bi-exponential atmosphere). [If you have a source code version of EGOPS read the file usratm.SampleFile in the /prog/FORprog subdirectory of EGOPS in case you want to learn more about how to supply your own user-supplied atmosphere.]

  - Atmospheric disturbance model: No disturbance, or gravity wave superposed, or frontal system gradient superposed, or tropopause fold superposed, or atmospheric inversion superposed.

  - Climatological ionospheric model: No ionosphere, or simple double-Chapman ionosphere, or full 3D ionosphere.

  - Ionospheric disturbance model: No disturbance, or traveling ionospheric disturbance (TID) superposed, or ionos. gradient superposed, or ionos. trough superposed, or ionos. storm effect superposed.

- Sampling rates for forward modeling:
500 Hz, or 250 Hz, or 100 Hz, or 50 Hz, or 25 Hz, or 10 Hz, or 5 Hz, or 1 Hz, or 0.1 Hz for the L1 frequency (if the upper limit of the occultation event height is larger than 90 km the L1 sampling rates are limited to a maximum of 50 Hz, for airborne occultations the maximum L1 sampling rate is only 5 Hz) and, for the L2 frequency, one rate of the above which is equally high or lower than the L1 rate. In case of modeling a sample of events including GPS and GLONASS events, the L2 rate for GLONASS can be set to a different rate than L2/GPS.

- Signal propagation simulator:
Quasi-3D ray tracing (considering, in terms of refractivity gradients, the radial gradient only), full-3D ray tracing (accounting for the full-3D refractivity gradient field), or wave optics propagator (for a more realistic computation dealing with diffraction and multipath effects). Accuracy of ray-tracing from GNSS to LEO can be set to be <~ 1 mm, or <~ 1 cm, or <~ 10 cm (less demanding accuracy allowing faster computations but yielding more inaccurate simulated phase observables) for the first two signal propagation simulators whereas the ray tracer accuracy for the wave optics propagator can be set to be 'High', 'Medium', or 'Low'.

FoMod VISUALIZATION

EGOPS provides for the visualization of results of Forward Modeling tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for FoMod tasks, to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "atmospheric(/ionospheric) excess phase"

and "atmospheric(/ionospheric) power loss") as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different FoMod tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

5.4 Forward Modeling Input

5.4.1 FoMod/Task-Id

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)

The FoMod/Task-id is the name and identification of the Forward Modeling (FoMod) Task you are currently supplying the input for.
It is the key identification means for EGOPS to separate all files relating to your current simulation activity (which will actually start when you go for 'Save & Compute' in the bottom button row) from others with different inputs (which you will assign different Task-ids). In fact, all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Forward Modeling will be saved in the /FoMod subdirectory of the /<Project-id> directory of your current Project. (Consult the "Help on Project/About Projects" entry at the menu level in case you need to learn what an EGOPS "Project" and "Project-id" are.)

SPECIAL NOTES/HINTS

- Assign your Task a "smart" Task-id which conveys some hint to you on what this Task is about. See it like choosing a good brief title for your Task. (Among other things, this is very helpful during the visualization/validation of your results, when your primary selector will be just the Task-id assigned here.)

INPUT PARAMETER(S)

1) === INPUT FIELD for assigning a FoMod/Task-id ===

Purpose:
Allows the assignment of a FoMod/Task-id to your current Task by keyboard input.

Type:
Text input field for input of the Task-id.

Format/Usage:
Supply an arbitrary alphanumeric string of up to 25 characters which may also contain hyphen or underline characters. Longer strings,

```
      intermediate blanks, or use of other characters are not allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All strings which are compliant with the above defined format.
      The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
      'LetslearnEGOPS' are recognized as different). You will be
      properly warned in case you choose a Task-id which already exists
      from prior work or by default.

   Notes on Values:
      Hint - Avoid strings which may blame, annoy, seize up, etc., your
      colleague(s), who may potentially work with the same EGOPS...

   Availability/Indirect Effects:
      Always available. Remember that the Task-id will be the key name
      throughout the entire EGOPS system for identifying your current Task.


2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing FoMod/Task-id ===

   Purpose:
      Allows to select an existing Task-id out of all existing ones.
      (Most convenient in case a prior Task shall be re-run with only
      slight modifications, which is typically a very frequent case.)

   Type:
      Pop-up Window which allows to select by mouse click a string entry
      from a list of available entries.

   Format/Usage:
      Press the button which causes a select-list window to pop-up. Select
      by mouse click a Task-id out of the available ones in the list (which
      is highlighted upon selection; note that always a default is already
      set). Confirm your selection with "Ok" or choose "Cancel" to return
      without action.

   Range of Values:
      Any Task-id available in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Available only if more than one Task already exists (otherwise
      the only existing Task-id - FoModdefault - is automatically selected
      and the button/select-list window is set insensitive).


3) ===  BUTTON/DELETE WINDOW for deleting existing FoMod/Task-ids ===========

   Purpose:
      Allows to select one (or more) existing Task-id (s) out of all
      existing ones for deleting (only the FoModdefault Task-id cannot
      be deleted). Specifically, all information relating to the chosen
      Forward Modeling Task-id (s) will be deleted in the /FoMod sub-
      directory of the /<Project-id> directory of the currently open
      Project.

   Type:
      Pop-up Window which allows to select by mouse click a Task-id entry
      from a list of available entries for deleting.

   Format/Usage:
      Press the button which causes a special delete window to pop-up.

   Range of Values:
      ---

   Notes on Values:
      ---
```

```
    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise
       the only existing Task-id - FoModdefault - is not allowed to be
       deleted and the delete window button is set insensitive).
```

INPUT EXAMPLE(S)

```
- Naming one of a series of FoMod Training Tasks:
   Set input field to 'LetsLearnEGOPS-3'
   (The button/select-list window need not be touched)

- Selecting an earlier Training Task of the above series:
   (The input field need not be touched)
   Select the Task-id 'LetsLearnEGOPS-2' by using the button/select-list window
```

5.4.2 Occultation Event Simulation Type

GENERAL DESCRIPTION

This input allows to specify one of 5 different Occultation Event Simulation Types. For every simulation type, the corresponding input window will be mapped in the framed section below the Occultation Event Simulation Type droplist. For spaceborne cases, it is possible to choose amongst Single Event/Ideal Geometry, Single Event/Realistic Geometry, Sample of Events/Realistic Geometry, whereas in case of airborne events Airborne Occultation - Ideal Event, and Airborne Occultation - Realistic Event are possible selections.

SPECIAL NOTES/HINTS

- If the droplist is set to Sample of Events/Realistic Geometry, the Atmosphere/Ionosphere Models Choice allows no Atmosphere/Ionosphere Disturbance Model to be selected.

INPUT PARAMETER(S)

```
 1) === DROPLIST for Occultation Event Simulation Type ===

    Purpose:
       Allows the selection among Single Event/Ideal Geometry, Single
       Event/Realistic Geometry, Sample of Events/Realistic Geometry,
       Airborne Occultation - Ideal Event, and Airborne Occultation -
       Realistic Event.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 5 values: 'Single Event/Ideal Geometry',
       'Single Event/Realistic Geometry', 'Sample of Events/Realistic
       Geometry', 'Airborne Occultation - Ideal Event', and 'Airborne
       Occultation - Realistic Event'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.
```

INPUT EXAMPLE(S)

- Selecting sample of events/realistic geometry:
  Set droplist to 'Sample of Events/Realistic Geometry'.

5.4.3 Single Event/Ideal Geometry Specifications

GENERAL DESCRIPTION

This input group allows to specify the Tangent Point Location, the Azimuth of the Occultation Plane, the Occultation Event Start Date/Time, the Satellite Heights and the Occultation Event Height Range for the Single Event/Ideal Geometry Specification. Ideal Geometry Specification means that straight lines are used as connection between the GNSS- and LEO-Satellite.

SPECIAL NOTES/HINTS

- Only Occultation Event Start Date/Times between 1990 and 2089 are allowed.
- Minimum/maximum Satellite Heights are between 150 km and 100000 km.
- The Speed of Airplane input field has no meaning in this case and is insensitive (its only sensitive in case of an Airborne Occultation - Ideal Event).

INPUT PARAMETER(S)

1) === INPUT FIELD for the input of the Tangent Point Location ===

   Purpose:
      Allows the input of the Tangent Point Location (Latitude and Longitude in degrees) by keyboard input.

   Type:
      Text input field for input of the 2 numerical values for the Tangent Point Location.

   Format/Usage:
      Supply the two numerical values with a maximum of one post-comma digit per value. Both values should be separated by at least one blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Latitude from -89.0 to 89.0 deg (note that the geographic poles of the earth are not allowed in this context), Longitude from -180.0 to 180.0 deg.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.

2) === INPUT FIELD for the input of the Azimuth Occultation Plane ===

   Purpose:
      Allows the input of the Azimuth Occultation Plane by keyboard input.

   Type:
      Text input field for input of the Azimuth Occultation Plane value.

   Format/Usage:
      Put in the number of the Azimuth Occultation Plane orientation (only integers are allowed). North is 0 [deg], West is 90 [deg] and so on.
      Press <CR> to deliver the input to the system.

```
   Range of Values:
      From 0 to 360 deg.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.


3) === INPUT FIELD for the input of the Occultation Event Start Date/Time ===

   Purpose:
      Allows the input of the Occultation Event Start Date/Time by
      keyboard input.

   Type:
      Text input field for input of the Occultation Event Start
      Date/Time string.

   Format/Usage:
      Put in first the last two numbers of the chosen year, next two
      positions are reserved for the month followed by the number of
      the selected day. After a dot then enter the starting time
      beginning with the hours then the  minutes and seconds (in each
      case two digits are necessary for the correct input). Intermedidate
      blanks are not allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      For the year from 90,...,99,00,01,...,89 (that means from 1990 till
      2089), months from 01 (January) till 12 (December), and for the
      days the range depends on the chosen month (i.e. February 01 - 28
      or 29 if it's a leap-year, October 01 - 31 and so on). Value ranges
      for hours are from 00 to 23 and for minutes and seconds are from
      00 to 59.

   Notes on Values:
      Only numbers are allowed (and the dot at the correct position).

   Availability/Indirect Effects:
      Always available.


4) === INPUT FIELD for the input of the Satellite Heights ===

   Purpose:
      Allows the input of the Satellite Heights by keyboard input.

   Type:
      Text input field for input of the Satellite Heights numbers.

   Format/Usage:
      First put in the Satellite Height of the LEO and than specify
      the Satellite Height of the GNSS. Both values should be separated
      at least by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      LEO Satellite Height range can vary from 200 - 5000 km, GNSS Height
      ranges are between 5000 and 50000 km.

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available.


5) === INPUT FIELD for the input of the Occultation Event Height Range ===
```

```
    Purpose:
       Allows the input of the Occultation Event Height Range by
       keyboard input.

    Type:
       Text input field for input of the Occultation Event Height
       Range numbers.

    Format/Usage:
       Put in first the lower limit of the Occultation Event Height Range
       (Hlo) and then the upper limit of the Occultation Event Height
       Range (Hhi) interval. One digit after the comma will be accepted.
       Both values should be at least separated by a blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Hlo from 0.0 to 30 km and Hhi from 70 to 120 km in case of an atmos-
       phere (for ionospheres the limits for Hlo can vary from 0.0 to 200 km
       and Hhi from 500 km to the lowest perigee of the chosen LEO satel-
       lites). Only values which are multiples of the step size (last number
       before the comma in the explanation label right of the input field)
       will be accepted. For later InRet simulations, if the lowest used
       FoMod Sampling Rate at relevant GNSS frequencies is higher or equal
       5 Hz, the allowed limits for Hlo are set from 0.0 to Hhi-8 km and for
       Hhi are set from Hlo+8 to 120 km in an atmospheric case (for iono-
       spheres the limits specified before are unchanged). Default values
       are 0.0 km for Hlo and 80.0 km for Hhi.

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting a Occultation Event Start Date/Time:
   If you want to start on the 13th June 2007 at 9 h 43 min and 6 sec,
   then set input field to '070613.094306'

- Selecting a Tangent Point Location:
   For the Tangent Point Location of 33.4 [deg] south and 153.6 [deg] west,
   set input field to '-33.4 -153.6'.
```

5.4.4 Single Event/Realistic Geometry Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Reference MAnPl/Task-id, the
corresponding Infos on (that) Task, the Occultation Event Number, and
the Occultation Event Height Range. Realistic Geometry Specification
means also bended lines as connection between the GNSS- and LEO-Satellite
are allowed.


SPECIAL NOTES/HINTS

- It is possible to choose the Reference MAnPl/Task-id by clicking the
  'Reference MAnPl/Task-id...'-button and select one Task-id from the
  list or by directly putting in the name of the Reference MAnPl/Task-id
  into the foreseen textfield.


INPUT PARAMETER(S)

 1) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing MAnPl/Task-id ===
```

Purpose:
Allows to select an existing Task-id out of all existing ones. (This is most convenient in case a prior Task shall be re-run with only slight modifications)

Type:
Pop-up Window which allows to select by mouse click a Task-id entry from a list of available entries.

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse click a Task-id out of the available ones in the list (which is highlighted upon selection; note that always a default is already set). Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:
Any Task-id available in the list.

Notes on Values:

Availability/Indirect Effects:
Available only if more than one Task already exists (otherwise the only existing Task-id - MAnPldefault - is automatically selected and the button/select-list window is set insensitive).

2) === INPUT FIELD for assigning a MAnPl/Task-id ===

Purpose:
Allows the assignment of a MAnPl/Task-id to your current Task by keyboard input.

Type:
Text input field for input of the Task-id.

Format/Usage:
Supply an arbitrary alphanumeric string of up to 25 characters which may also contain hyphen or underline characters. Longer strings, intermediate blanks, or use of other characters are not allowed. Press <CR> to deliver the input to the system.

Range of Values:
All strings which are compliant with the above defined format. The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and 'LetslearnEGOPS' are recognized as different). You will be properly warned in case you choose a Task-id which already exists from prior work or by default.

Notes on Values:
Hint - Avoid strings which may blame, annoy, seize up, etc., your colleague(s), who may potentially work with the same EGOPS...

Availability/Indirect Effects:
Always available. Remember that the Task-id will be the key name throughout the entire EGOPS system for identifying your current Task.

3) === Button for showing Infos on Task in ===

Purpose:
To show a brief summary of the whole input status of the Reference MAnPl/Task-id input.

Type:
Pop-up Window which shows all entries of the Reference MAnPl/Task-id input.

Format/Usage:
Press the Button which causes a text window to pop-up.

```
   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Button is always available.


4) === INPUT FIELD for the input of the Occultation Event Number ===

   Purpose:
      Allows the input of the Occultation Event Number by keyboard input.

   Type:
      Text input field for input of the Occultation Event Number.

   Format/Usage:
      Put in the Occultation Event Number (it's naturally an integer).

   Range of Values:
      Depends on the occultation numbers in the corresponding MAnPl/
      MAnPl/Task-id.sgd-file. These numbers will be always shown in the
      explanation label (right of the input field).
      Press <CR> to deliver the input to the system.

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available.


5) === INPUT FIELD for the input of the Occultation Event Height Range ===

   Purpose:
      Allows the input of the Occultation Event Height Range by
      keyboard input.

   Type:
      Text input field for input of the Occultation Event Height
      Range string.

   Format/Usage:
      Put in first the lower limit of the Occultation Event Height Range
      (Hlo) and then the upper limit of the Occultation Event Height
      Range (Hhi) interval. One digit after the comma will be accepted.
      Both values should be at least separated by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Hlo from 0.0 to 30 km and Hhi from 70 to 120 km in case of an atmos-
      phere (for ionospheres the limits for Hlo can vary from 0.0 to 200 km
      and Hhi from 500 km to the lowest perigee of the chosen LEO satel-
      lites). Only values which are multiples of the step size (last number
      before the comma in the explanation label right of the input field)
      will be accepted. For later InRet simulations, if the lowest used
      FoMod Sampling Rate at relevant GNSS frequencies is higher or equal
      5 Hz, the allowed limits for Hlo are set from 0.0 to Hhi-8 km and for
      Hhi are set from Hlo+8 to 120 km in an atmospheric case (for iono-
      spheres the limits specified before are unchanged). Default values
      are 0.0 km for Hlo and 80.0 km for Hhi.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.
```

```
INPUT EXAMPLE(S)

- Selecting a Occultation Event Height Range:
   Set Hlo to 6.0 and Hhi to 80.0 km.
   Set input field to '6.0 80.0'.
```

5.4.5 Sample of Events/Realistic Geometry Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Reference MAnPl/Task-id, the
corresponding Infos on (that) Task, the Occultation Number Range, and
the Occultation Event Height Range. Realistic Geometry Specification
means also bended lines as connection between the GNSS- and LEO-Satellite
are allowed.


SPECIAL NOTES/HINTS

- It is possible to choose the Reference MAnPl/Task-id by clicking the
  'Reference MAnPl/Task-id...'-button and select one Task-id from the
  list or by directly putting in the name of the Reference MAnPl/Task-id
  into the foreseen text field.


INPUT PARAMETER(S)

 1) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing MAnPl/Task-id ===

    Purpose:
       Allows to select an existing Task-id out of all existing ones.
       (Most convenient in case a prior Task shall be re-run with only
       slight modification, which is typically a very frequent case.)

    Type:
       Pop-up Window which allows to select by mouse click an entry
       from a list of available entries.

    Format/Usage:
       Press the button, which causes a select-list window to pop-up. Select
       by mouse click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise,
       the only existing Task-id - MAnPldefault - is automatically
       selected and the button/select-list window is insensitive).


 2) === INPUT FIELD for assigning a MAnPl/Task-id ===

    Purpose:
       Allows the assignment of a MAnPl/Task-id to your current
       Task by keyboard input.

    Type:
       Text input field for input of the Task-id.

    Format/Usage:
       Supply an arbitrary alphanumeric string of up to 25 characters which
```

may also contain hyphen or underline characters. Longer strings, intermediate blanks, or use of other characters are not allowed.
Press <CR> to deliver the input to the system.

Range of Values:
All strings compliant with the above defined format.
The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and 'LetslearnEGOPS' are recognized as different). You will be properly warned in case you choose a Task-id which already exists from prior work or by default.

Notes on Values:
Hint - Avoid strings which may blame, annoy, seize up, etc., your colleague(s), who may potentially work with the same EGOPS...

Availability/Indirect Effects:
Always available. Remember that the Task-id will be the key name throughout the entire EGOPS system for identifying your current Task.

3) === Button for showing Infos on Task in ===

Purpose:
To show a brief summary of the whole input status of the Reference MAnPl/Task-id Input.

Type:
Pop-up Window which shows all entries of the Reference MAnPl/Task-id input.

Format/Usage:
Press the Button to open the corresponding Pop-up Window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Button is always available.

4) === INPUT FIELD for input of the Occultation Number Range ===

Purpose:
Allows the input of the Occultation Number Range by keyboard input.

Type:
Text input field for input of the Occultation Number Range.

Format/Usage:
Put in the 3 Occultation Number Range values for the lower- (lo), upper- (hi) Occultation Number Range and for the step size (all of them are integers). All 3 values should be at least separated by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Depends one the Occultation Number Range in the corresponding MAnPl/MAnPl/Task-id.sgd-file. These Occultation Number Range will be always shown in the explanation label (to right of the input field).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

5) === INPUT FIELD for the input of the Occultation Event Height Range ===

Purpose:
Allows the input of the Occultation Event Height Range by keyboard input.

Type:
Text input field for input of the Occultation Event Height Range.

Format/Usage:
Put in first the lower limit of the Occultation Event Height Range (Hlo) and then the upper limit of the Occultation Event Height Range (Hhi) interval. One digit after the comma will be accepted. Both values should be at least separated by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Hlo from 0.0 to 30 km and Hhi from 70 to 120 km in case of an atmosphere (for ionospheres the limits for Hlo can vary from 0.0 to 200 km and Hhi from 500 km to the lowest perigee of the chosen LEO satellites). Only values which are multiples of the step size (last number before the comma in the explanation label right of the input field) will be accepted. For later InRet simulations, if the lowest used FoMod Sampling Rate at relevant GNSS frequencies is higher or equal 5 Hz the allowed, limits for Hlo are set from 0.0 to Hhi-8 km and for Hhi are set from Hlo+8 to 120 km in an atmospheric case (for ionospheres the limits specified before are unchanged). Default values are 0.0 km for Hlo and 80.0 km for Hhi.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Selecting a Occultation Number Range:
  Set the lower Occ. No. (lo) to 1 and the upper Occ. No. (hi) to 29 with a step size of 7.
  Set the input field to '1 29 7'.

- Selecting a Occultation Event Height Range:
  Set Hlo to 6.0 and Hhi to 80.0 km.
  Set input field to '6.0 80.0'.

5.4.6 Airborne Occultation - Ideal Event

GENERAL DESCRIPTION

This input group allows to specify the Tangent Point Location, the Azimuth of the Occultation Plane, the Occultation Event Start Date/Time, the Airplane/Sat Heights, the Occultation Event Height Range and the Airplane Speed for the Airborne Occultation - Ideal Geometry Specification. Ideal Geometry Specification means that only straight lines as connection between the GNSS and the Airplane are allowed.

SPECIAL NOTES/HINTS

- Only Occultation Event Start Date/Times between 1990 and 2089 are allowed.
- Minimum/maximum Airplane Heights are between 8 km and 16 km.
- Minimum/maximum Airplane Speed are between 300 km/h and 3000 km/h.

INPUT PARAMETER(S)

```
1) === INPUT FIELD for the input of the Tangent Point Location ===

   Purpose:
      Allows the input of the Tangent Point Location (Latitude and
      Longitude in degrees) by keyboard input.

   Type:
      Text input field for input of the 2 numerical values for the
      Tangent Point Location.

   Format/Usage:
      Supply the two numerical values with a maximum of one post-comma
      digit per value. Both values should be separated by at least one
      blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Latitude from -90.0 to 90.0 deg (note that the geographic poles
      of the earth are not allowed to be specified in this context),
      Longitude from -180.0 to 180.0 deg.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.


2) === INPUT FIELD for the input of the Azimuth Occultation Plane ===

   Purpose:
      Allows the input of the Azimuth Occultation Plane by
      keyboard input.

   Type:
      Text input field for input of the Azimuth Occultation Plane value.

   Format/Usage:
      Put in the number of the Azimuth Occultation Plane orientation
      (only integers are allowed). North is 0 [deg], West is 90 [deg]
      and so on.
      Press <CR> to deliver the input to the system.

   Range of Values:
      From 0 to 360 deg.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.


3) === INPUT FIELD for the input of the Occultation Event Start Date/Time ===

   Purpose:
      Allows the input of the Occultation Event Start Date/Time by
      keyboard input.

   Type:
      Text input field for input of the Occultation Event Start
      Date/Time string.

   Format/Usage:
      Put in first the last two numbers of the chosen year, next two
      positions are reserved for the month followed by the number of
      the selected day. After a dot then enter the starting time
      beginning with the hours then the  minutes and seconds (in each
      case two digits are necessary for the correct input). Intermediate
      blanks are not allowed.
```

```
      Press <CR> to deliver the input to the system.

   Range of Values:
      For the year 90,...,99,00,01,...,89 (that means from 1990 till
      2089), months from 01 (January) till 12 (December), and for the
      days the range depends on the chosen month (i.e. February 01 - 28
      or 29 if it's a leap-year, October 01 - 31 and so on). Value ranges
      for hours are from 00 to 23 and for minutes and seconds are from
      00 to 59.

   Notes on Values:
      Only numbers are allowed (and the dot at the correct position).

   Availability/Indirect Effects:
      Always available.


4) === INPUT FIELD for the input of the Airplane/Satellite Heights ===

   Purpose:
      Allows the input of the Airplane Trajectory and GNSS Satellite
      Heights by keyboard input.

   Type:
      Text input field for input of the Airplane and Satellite Heights
      numbers.

   Format/Usage:
      First put in the Airplane Trajectory Height and than specify the
      Satellite Height of the GNSS. Both values should be separated
      at least by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Airplane Height range can vary from 8 - 16 km, GNSS Height
      ranges are between 5000 and 50000 km.

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available.


5) === INPUT FIELD for the input of the Occultation Event Height Range ===

   Purpose:
      Allows the input of the Occultation Event Height Range by
      keyboard input.

   Type:
      Text input field for input of the Occultation Event Height
      Range numbers.

   Format/Usage:
      Put in first the lower limit of the Occultation Event Height Range
      (Hlo) and then the upper limit of the Occultation Event Height
      Range (Hhi) interval. One digit after the comma will be accepted.
      Both values should be at least separated by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Hlo from 0.0 to 3 km and Hhi from 8 to 16 km. Default values are
      0.0 km for Hlo and 10.0 km for Hhi.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.
```

```
 6) === INPUT FIELD for the input of the Speed of Airplane ===

    Purpose:
       Allows the input of the Airplane Speed by keyboard input.

    Type:
       Text input field for input of the Airplane Speed numbers.

    Format/Usage:
       Put in the Airplane Speed numbers by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Airplane Speed can vary from 300 - 3000 km/h.

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting a Occultation Event Start Date/Time:
   If you want to start on the 13th June 2007 at 9 h 43 min and 6 sec,
   then set input field to '070613.094306'

- Selecting a Tangent Point Location:
   For the Tangent Point Location of 33.4 [deg] south and 153.6 [deg] west,
   set input field to '-33.4 -153.6'.
```

5.4.7 Airborne Occultation - Realistic Event

```
GENERAL DESCRIPTION

This input group allows to choose the Begin and End location of the
airplane trajectory, to specify the GPS/GLON*.tle-file, to fix the
Start Date/Time of the airplane, the Height and Speed of the airplane
and the Occultation Event Height Range. After fixing these inputs, the
user selects one event for further calculations.


SPECIAL NOTES/HINTS

- It is possible to choose the Begin and End location of the airplane
  trajectory by direct keyboard input or to activate an extra graphical
  tool for a more elegant way of selection of the Begin and End location
  of the airplane trajectory by pressing the 'Begin/End Location...' -
  button.


INPUT PARAMETER(S)

 1) === BUTTON/SELECT WINDOW for selecting APT Begin/End Location ===

    Purpose:
       Allows to select the Begin/End Location of the AirPlaneTrajectory
       (APT) by direct input of location names or by clicking on the
       location from a list of available entries or by direct mouse click
       on a world map.

    Type:
       Pop-up Window which allows three different ways of selecting the
       APT Begin/End Location.

    Format/Usage:
       Press the button which causes a select-list window to pop-up.
```

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available.

2,3) === INPUT FIELDS for selection of APT Begin/End Location ===

Purpose:
Allows the selection of the APT Begin/End Location by keyboard input.

Type:
Text input fields for Latitude Longitude input of the APT Begin/End coordinates.

Format/Usage:
Put into the first input field the Latitude and Longitude number of the APT Begin and in the second input field the Latitude and Longitude number of the APT End location. Two digits after the comma will be accepted. Both values should be at least separated by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Latitude from -90.00 to 90.00 deg and Longitude from -180.0 to 180.0 deg.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

4) === Button for selecting GNSS Orbit Element File ===

Purpose:
This Pop-up Window allows the selection of a desired gps*tle or glon*.tle file existing in the /orbitelem subdirectory of EGOPS.

Type:
Button for activating the file selection tool.

Format/Usage:
Press the 'GPS/GLON*.tle...' button to open the Pop-up Window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always Available.

5) === INPUT FIELD for the input of the Start Date/Time APT ===

Purpose:
Allows the input of the Air Plane Trajectory Start Date/Time by keyboard input.

Type:
Text input field for input of the Start Air Plane Trajectory Date/Time string.

Format/Usage:

Put in first the last two numbers of the chosen year, next two positions are reserved for the month followed by the number of the selected day. After a dot then enter the starting time beginning with the hours then the minutes and seconds (in each case two digits are necessary for the correct input). Intermediate blanks are not allowed.
Press <CR> to deliver the input to the system.

Range of Values:
For the year from 90,...,99,00,01,...,89 (that means from 1990 till 2089), months from 01 (January) till 12 (December), and for the days the range depends on the chosen month (i.e. February 01 - 28 or 29 if it's a leap-year, October 01 - 31 and so on). Value ranges for hours are from 00 to 23 and for minutes and seconds are from 00 to 59.

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
Always available.

6) === INPUT FIELD for the input of the Occultation Event Height Range ===

Purpose:
Allows the input of the Occultation Event Height Range by keyboard input.

Type:
Text input field for input of the Occultation Event Height Range numbers.

Format/Usage:
Put in first the lower limit of the Occultation Event Height Range (Hlo) and then the upper limit of the Occultation Event Height Range (Hhi) interval. One digit after the comma will be accepted. Both values should be at least separated by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Hlo from 0.0 to 3 km and Hhi from 8 to 16 km. Default values are 0.0 km for Hlo and 10.0 km for Hhi.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

7) === BUTTON/SELECT WINDOW for selecting an occultation Event ===

Purpose:
Allows to select an occultation Event directly from the shown map by direct mouse click on the desired occultation number.

Type:
Pop-up Window which allows to select an occultation event.

Format/Usage:
Press the 'Select Event...' button which causes a select window to pop-up.

Range of Values:

Notes on Values:

Availability/Indirect Effects:

Always available.

8) === INPUT FIELD for the input of the Occultation Event number ===

Purpose:
Allows the input of the Occultation Event number by keyboard input.

Type:
Text input field for input of the Occultation Event number.

Format/Usage:
Put in the Occultation Event number (the lower and upper limits are shown in the information label on the right side of this input field.
Press <CR> to deliver the input to the system.

Range of Values:
These are shown in the information label on the right side of this input field.

Notes on Values:
Only integer numbers are allowed.

Availability/Indirect Effects:
Only available if the number of occultation events were calculated before by means of the 'Select Event...' pop-up tool.

INPUT EXAMPLE(S)

- Selecting Paris - Miami as Begin/End location of the APT:
First press the 'Begin/End Location...' button to open the select pop-up window. Then select Paris from the 'Select Start Location' list and choose Miami from 'Select End Location' list. Afterwards press the 'Quit' button to accept the former selection and to close the select pop-up window.

- Selecting a Occultation Event Height Range:
Set Hlo to 2.0 and Hhi to 10.0 km.
Set input field to '2.0 10.0'.

5.4.8 Atmosphere Climatology Model

GENERAL DESCRIPTION

The first droplist allows to specify amongst 5 different Atmosphere Climatology Models (Bi-Exponential Atm. (RefAtm_UoG), HLat 2D Atmosphere (CIRA86aQ_UoG), 3D Atmosphere dry (MSIS90_DMI), GCM 3D Atmosphere (GCM3DAtm), HiVRes Atmosphere (HiVResAtm), and a User-supplied Atmosphere) and the No Atmosphere case. The second droplist allows to switch between dry- and moist air, and the third one offers the choice between two different types of Atmosphere Model Structures.

SPECIAL NOTES/HINTS

- In the "No Atmosphere" case, obviously, the second and third droplists are inactive. Dry Atmosphere Climatology Models do not allow to include Humidity (moist air).
- If "No Atmosphere" or a Atmosphere Climatology Model with Humidity included is used then it is not possible to choose a Atmosphere Disturbance Model (corresponding droplist will be set to insensitive).

INPUT PARAMETER(S)

1) === DROPLIST for Atmosphere Climatology Model ===

Purpose:

```
      Allows a selection among the No Atmosphere case, Bi-Exponential
      Atmosphere (RefAtm_UoG), HLat 2D Atmosphere (CIRA86aQ_UoG), 3D
      Atmosphere dry (MSIS90_DMI), GCM 3D Atmosphere (GCM3DAtm), HiVRes
      Atmosphere (HiVResAtm), and a User-supplied Atmosphere.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 5 values: 'No Atmosphere', 'Bi-Exponential
      Atm. (RefAtm_UoG)', 'HLat 2D Atmosphere (CIRA86aQ_UoG)', '3D
      Atmosphere dry (MSIS90_DMI)', 'GCM 3D Atmosphere (GCM3DAtm)...',
      'HiVRes Atmosphere (HiVResAtm)...', 'User-supplied Atmosphere
      (RefAtm_UoG)'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is always available.


2) === DROPLIST for Humidity ===

   Purpose:
      Allows the selection between No Humidity included (dry air)
      and Humidity included (moist air).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following two values: 'No Humidity included (dry air)',
      'Humidity included (moist air)'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available if Atmosphere Climatology Models
      which allow to include Humidity are selected.


3) === DROPLIST for Atmosphere Structure Model choice ===

   Purpose:
      Allows the selection between the Atmosphere Model Structure as is
      and a Spherical Symmetric Atmosphere Model Structure (a structure
      with no horizontal variations).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'Atmos. Model Structure as is',
      'Sph. Symmetry (no horiz. var.)'.

   Notes on Values:
      ---
```

```
    Availability/Indirect Effects:
       The droplist is always available (the only exception is in the
       'No Atmosphere' case).


INPUT EXAMPLE(S)

- Selecting HLat 2D Atmosphere:
   Set droplist to 'HLat 2D Atmosphere (CIRA86aQ_UoG)'.
```

5.4.9 Atmosphere Disturbance Model

```
GENERAL DESCRIPTION

This input allows to choose among "No Atmospheric Disturbance super-
posed" and 4 Atmospheric Disturbance Models ("Gravity Wave superposed...",
"Frontal System Gradient superposed...", "Tropopause Fold superposed...",
and "Atmospheric Inversion superposed...").


SPECIAL NOTES/HINTS

- This droplist is only available for a dry Atmosphere Climatology Model,
  if Single Event/Ideal or Realistic Geometry was chosen as occultation
  event simulation type (humid atmospheres or Sample of Events/Realistic
  Geometry will not be supported).


INPUT PARAMETER(S)

 1) === DROPLIST for Atmosphere Disturbance Model ===

    Purpose:
       Allows the selection among the "No Atmospheric Disturbance
       superposed" and 4 Atmospheric Disturbance Models ("Gravity Wave
       superposed...", "Frontal System Gradient superposed...", "Tropopause
       Fold superposed...", and "Atmospheric Inversion superposed...").

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 5 values: 'No Atmospheric Disturbance super-
       posed', 'Gravity Wave superposed...', 'Frontal System Gradient
       superposed...', 'Tropopause Fold superposed...', and 'Atmospheric
       Inversion superposed...'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if a Atmosphere Climatology Model
       which allow to include Humidity and Single Event/Ideal or Realistic
       Geometry is chosen.


INPUT EXAMPLE(S)

- Selecting gravity wave superposed:
   Set droplist to 'Gravity Wave superposed...'
```

5.4.10 Ionosphere Climatology Model

GENERAL DESCRIPTION

The droplist allows to select among 2 different Ionosphere Climatology Models (Double-Chapman Ionosphere (RefIon_UoG), 3D Ionosphere (Iono3D_UoG)), and the No Ionosphere case. The input field allows to specify the value of the Solar Activity Index (EGOPS uses the so called "F10.7 Index"). two different types of Ionosphere Model Structures are also available.

SPECIAL NOTES/HINTS

- In the "No Ionosphere" case, obviously, the input field for the Solar Activity and the droplist for the Ionosphere Model Structure choice is inactive and it is not possible to choose a Ionosphere Disturbance Model (the corresponding droplist will then be set insensitive).

INPUT PARAMETER(S)

1) === DROPLIST for Ionosphere Climatology Model ===

Purpose:
Allows the selection amongst the No Ionosphere case, Double-Chapman Ionosphere (RefIon_UoG), and the 3D Ionosphere (Iono3D_UoG) Model.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following 3 values: 'No Ionosphere', 'Double-Chapman Ion. (RefIon_UoG)', '3D Ionosphere (Iono3D_UoG)'.

Notes on Values:

Availability/Indirect Effects:
The droplist is always available.

2) === INPUT FIELD for the input of the Solar Activity Index ===

Purpose:
Allows the input of the Solar Activity Index.

Type:
Text input field for input of the Solar Activity/F10.7 Index.

Format/Usage:
Put in the Solar Activity/F10.7 Index number.
Press <CR> to deliver the input to the system.

Range of Values:
From 75 to 220.

Notes on Values:
Only integer numbers are allowed.

Availability/Indirect Effects:
The input field is only available, if one of the two Ionosphere Climatology Models is selected.

3) === DROPLIST for Ionosphere Structure Model choice ===

```
    Purpose:
       Allows the selection among the Ionosphere Model Structure as is
       and a Spherical Symmetric Ionosphere Model Structure (a structure
       with no horizontal variations).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Ionos. Model Structure as is',
       'Sph. Symmetry (no horiz. var.)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if one of the two Ionosphere
       Climatology Models is selected.


INPUT EXAMPLE(S)

- Selecting 3D Ionosphere:
   Set droplist to '3D Ionosphere (Iono3D_UoG)'.
```

5.4.11 Ionosphere Disturbance Model

```
GENERAL DESCRIPTION

This input allows to choose among "No Ionospheric Disturbance super-
posed" and 4 Ionospheric Disturbance Models ("TID Event superposed...",
"Ionospheric Gradient superposed...", "Ionospheric Trough superposed...",
and "Ionospheric Storm Effect superposed...").


SPECIAL NOTES/HINTS

- This droplist is only available, if a Ionosphere Climatology Model
  and Single Event/Ideal or Realistic Geometry is chosen.


INPUT PARAMETER(S)

 1) === DROPLIST for Ionosphere Disturbance Model ===

    Purpose:
       Allows the selection amongst the "No Ionospheric Disturbance
       superposed" and 4 Ionospheric Disturbance Models ("TID Event
       superposed...", "Ionospheric Gradient superposed...", "Ionospheric
       Trough superposed...", and "Ionospheric Storm Effect superposed...").

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 5 values: 'No Ionos. Disturbance superposed',
       'TID Event superposed...', 'Ionos. Gradient superposed...', 'Ionos.
       Trough superposed...', and 'Ionos. Storm Effect superposed...'.

    Notes on Values:
       ---
```

```
    Availability/Indirect Effects:
       The droplist is only available, if an Ionosphere Climatology Model
       and Single Event/Ideal or Realistic Geometry is chosen.
```

INPUT EXAMPLE(S)

```
- Selecting TID event superposed:
   Set droplist to 'TID Event superposed...'
```

5.4.12 Sampling Rates at Relevant GNSS Frequencies

GENERAL DESCRIPTION

This input group currently allows to specify 3 different combinations of Sampling Rates at Relevant GNSS Frequencies (the L1 Sampling Rate for GPS+GLON, the L2 Sampling Rate for the US GPS, and the L2 Sampling Rate for the Russian GLONASS GNSS System). At least one option is always active (the number of active droplists depends on the settings of the corresponding MAnPl/Task-id).

SPECIAL NOTES/HINTS

- L1/L2 are the 2 used frequency bands of the GPS(GLONASS) Systems.
- GNSS is the generic acronym for the Global Navigation Satellite System (comprising the two existing systems GPS and GLONASS).
- GPS is the US Global Positioning System.
- GLONASS is the Russian GLObal NAvigation Satellite System.
- The wave optics propagator can only be used, if L1 is at least set to 10 Hz and, additionally, L1 and L2 must be set equal (L1 = L2).
- General InRet atmosphere processing needs 1 Hz as minimum sampling rate, whereas for InRet atm. inverse fresnel transform calculations at least 10 Hz are needed for computing (the maximum sampling rate for both cases is 50 Hz).

INPUT PARAMETER(S)

```
 1) === DROPLIST for L1/GPS+GLON Frequency Sampling Rates choice ===

    Purpose:
       Allows the selection amongst different L1/GPS+GLON frequencies.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following values: '500 Hz', '250 Hz', '100 Hz', '50 Hz',
       '25 Hz', '10 Hz', '5 Hz', '1 Hz', '0.1 Hz' (in case of an airborne
       occultation only '5 Hz', '1 Hz', '0.1 Hz' are possible sampling fre-
       quencies).

    Notes on Values:
       Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per
       second.

    Availability/Indirect Effects:
       The droplist is basically always available. The upper 3 frequency
       values ('500 Hz', '250 Hz', '100 Hz') are only available, if Hhi
       of the Occ. Event Height Range is 90.0 km or less.


 2) === DROPLIST for L2/GPS Frequency Sampling Rates choice ===
```

```
    Purpose:
       Allows the selection among different L2/GPS frequencies.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       In principle the same as under item 1), but the upper boundary
       is the value of the L1/GPS+GLON Frequency Sampling Rate setting.
       A further constraint is that L2 must be an integer divisor of L1.

    Notes on Values:
       Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per
       second.

    Availability/Indirect Effects:
       Availability of the droplist depends on the corresponding MAnPl/
       Task-id settings (i.e. GPS/none means that the droplist L2/GPS
       is insensitive).


 3) === DROPLIST for L2/GLON Frequency Sampling Rates choice ===

    Purpose:
       Allows the selection amongst different L2/GLON frequencies.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       In principle the same as under item 1), but the upper boundary
       is the value of the L1/GPS+GLON Frequency Sampling Rate setting.
       A further constraint is that L2 must be an integer divisor of L1.

    Notes on Values:
       Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per
       second.

    Availability/Indirect Effects:
       Availability of the droplist depends on the corresponding MAnPl/
       Task-id settings (i.e. GLON/none means that the droplist L2/GLON
       is insensitive).


INPUT EXAMPLE(S)

- Selecting 10 Hz as L1/GPS+GLON FoMod Frequency Sampling Rate:
   Set droplists to '10 Hz'.
```

5.4.13 Signal Propagation Simulator Specifications

GENERAL DESCRIPTION

This input group allows to specify one of three different Ray Tracer Types (Quasi-3D Ray Tracer, Full-3D Ray Tracer, and Wave Optics Propagator) and allows to choose amongst 3 different values for the Ray Tracer Accuracy. For faster calculations one should use the "Quasi-3D Ray Tracer", for more precise calculations, the "Full-3D Ray Tracer" or the Wave Optics Propagator is the adequate tool. For Airborne Occultations, only the Quasi-3D Ray Tracer and the Full-3D Ray Tracer are available.

```
SPECIAL NOTES/HINTS

- The choice of the Ray Tracer Accuracy is independent of the Ray Tracer
  Type.
- For the Wave Optics Propagator, the values of the Ray Tracer Accuracy
  droplist are changed from '< ~1mm', '< ~1cm', and '< ~10cm' to 'Highest',
  'Advanced', and 'Basic'.
- The Wave Optics Propagator supports only an atmosphere model selection
  (ionosphere models are not allowed in this case).


INPUT PARAMETER(S)

 1) === DROPLIST for Ray Tracer Type Choice ===

    Purpose:
       Allows the selection between Quasi-3D Ray Tracer, Full-3D Ray
       Tracer, and the Wave Optics Propagator type. In case of an
       Airborne Occultation, only the Quasi-3D Ray Tracer and the Full-
       3D Ray Tracer are available.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following three values: 'Quasi-3D Ray Tracer', 'Full-3D
       Ray Tracer', and 'Wave Optics Propagator' (for Airborne Occultations
       only the first two entries are available).

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available. The wave optics propagator can
       only be used, if the sampling rates at relevant GNSS frequencies
       L1 is at least set to 10 Hz and, additionally, L1 and L2 must be
       set equal (L1 = L2).


 2) === DROPLIST for Ray Tracer Accuracy Choice ===

    Purpose:
       Allows the selection between 1mm, 1cm, and 10cm Ray Tracer
       Accuracy (in case of 'Quasi-3D Ray Tracer' or 'Full-3D Ray Tracer')
       or between 'Highest', 'Advanced', and 'Basic' Ray Tracer Accuracy
       (in case of the 'Wave Optics Propagator').

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: '< ~1 mm' or 'Highest', '< ~1cm' or
       'Advanced', and '< ~10 cm' or 'Basic'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.
```

```
INPUT EXAMPLE(S)

- Selecting Quasi-3D Ray Tracer:
   Set droplist to 'Quasi-3D Ray Tracer'
```

5.4.14 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.4.15 Save & Compute

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.3, titled "Save & Compute" .

5.4.16 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

5.4.17 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

5.4.18 Save Input

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.4, titled "Save Input" .

5.4.19 Input Summary

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.3.1, titled "Input Summary" .

5.4.20 Delete FoMod-Tasks Input

5.4.20.1 Delete Task-Ids

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.5.1, titled "Delete Task-Ids" .

5.4.21 Airborne Start/End Location Input

5.4.21.1 Start and End Location for Airborne Occultations

```
GENERAL DESCRIPTION

This input group allows to choose the Begin and End location of the
airplane trajectory via keyboard input or by selecting the desired
Begin and End Locations per mouse-click from the city-list or by direct
mouse-click on the map.


SPECIAL NOTES/HINTS

- It is possible to choose the Begin and End location via different
  methods for the Begin and End location of the Air Plane Trajectory
  (APT).


INPUT PARAMETER(S)

 1) === INPUT FIELD for Select APT Start Location ===

    Purpose:
       Allows to select the APT Begin Location by keyboard input.

    Type:
       Text input field for APT Start Location name.

    Format/Usage:
       Put in the characters of the chosen start location name (in most
       cases the first three characters will be sufficient to highlight the
       desired location in the city-list; it might then be quicker to click
       on the marked name in the list instead of finishing writing the
       location name).
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       Only characters are allowed. Strings that are not in the city list
       will not be accepted.

    Availability/Indirect Effects:
       Always available.


 2) === LIST for Select APT Start Location ===

    Purpose:
       Allows to select the Begin Location of the Air Plane Trajectory
       (APT) by selecting the desired location from a list of available
       entries via mouse-click.

    Type:
       List widget which allows direct selecting of the APT Start Location.

    Format/Usage:
       Click with the mouse on the desired name of the APT Start Location.

    Range of Values:
       ---

    Notes on Values:
       ---
```

```
   Availability/Indirect Effects:
      Always available.


3) === Button for Selecting APT Start Location from Map by Mouse ===

   Purpose:
      This button activates the map selecting mode.

   Type:
      Button for activating the map selecting mode.

   Format/Usage:
      Press the 'Select from Map by Mouse' button to change to the map
      selecting cursor mode. Position the cursor to the APT starting
      point and click with the left mouse button to fix the APT Start
      coordinates.

   Range of Values:
      Any APT Start position is valid.

   Notes on Values:
      The chosen APT start coordinates will be written into the bottom
      line of the Select Start Location window.

   Availability/Indirect Effects:
      Always Available.


4) === INPUT FIELD for Select APT End Location ===

   Purpose:
      Allows the selection of the APT End Location by keyboard input.

   Type:
      Text input field for APT End Location name.

   Format/Usage:
      Put in the characters of the chosen end location name (in most
      cases the first three characters will be sufficient to highlight the
      desired location in the city-list; it might then be quicker to click
      on the marked name in the list instead of finishing writing the
      location name).
      Press <CR> to deliver the input to the system.

   Range of Values:
      ---

   Notes on Values:
      Only characters are allowed. Strings that are not in the city list
      will not be accepted.

   Availability/Indirect Effects:
      Always available.


5) === LIST for Select APT End Location ===

   Purpose:
      Allows to select the End Location of the Air Plane Trajectory
      (APT) by selecting the desired location from a list of available
      entries via mouse-click.

   Type:
      List widget which allows direct selecting of the APT End Location.

   Format/Usage:
      Click with the mouse on the desired name of the APT End Location.

   Range of Values:
      ---
```

```
   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


6) === Button for Selecting APT End Location from Map by Mouse ===

   Purpose:
      This button activates the map selecting mode.

   Type:
      Button for activating the map selecting mode.

   Format/Usage:
      Press the 'Select from Map by Mouse' button to change to the map
      selecting cursor mode. Position the cursor to the APT ending
      point and click with the left mouse button to fix the APT End
      coordinates.

   Range of Values:
      Every APT End position is possible.

   Notes on Values:
      The chosen APT End coordinates will be written into the bottom
      line of the Select End Location window.

   Availability/Indirect Effects:
      Always Available.


7) === WINDOW for selection/showing the APT Start/End Location ===

   Purpose:
      Allows to select the Air Plane Trajectory (APT) Start/End Location
      via mouse-click and/or graphically shows the APT on a world map.

   Type:
      Draw widget for showing the world map with the APT included.

   Format/Usage:
      After pressing the 'Select from Map by Mouse' button, fix the APT
      Start/End Location via mouse-click.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


8) === BUTTON to Quit Begin and End Location Pop-up Window ===

   Purpose:
      Pressing the 'Quit' button causes all selected values to be accepted
      as the current ATP Begin and End Location input (whereas pressing
      'Cancel' means to drop the changes just made in this input window).
      After clicking 'Quit', the Begin and End Location selection for Air-
      borne Occultations Pop-up Window is closed.

   Type:
      Button for saving an closing the Begin and End Location selection for
      Airborne Occultations Pop-up Window.

   Format/Usage:
      Press the 'Quit' button to save the window content and close the
```

```
      Begin and End Location selection for Airborne Occultations Pop-up
      Window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always Available.
```

```
INPUT EXAMPLE(S)

- Selecting Paris - Miami as Begin/End location of the APT:
    Select Paris from the 'Select Start Location' list and then choose Miami
    from the 'Select End Location' list. Afterwards, press the 'Quit' button
    to accept the former selection and to close the select pop-up window.
```

5.4.22 GPS/GLONASS Two Line Element File Input

5.4.22.1 GPS/GLON*.tle...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.7.1, titled "File Selection" .

5.4.23 Airborne Occultation Event Selection Input

5.4.23.1 Occultation Event Selection for Realistic Airborne Occultations

```
GENERAL DESCRIPTION

This input group allows to select an occultation event from the whole set
of events shown in the draw window. The selection can be done directly via
keyboard input or by selecting the desired occultation event per mouse-click
from the map.


SPECIAL NOTES/HINTS

- After initially opening the Occultation Event Selection for Realistic
  Airborne Occultations pop-up window (the 'Select Event...' button is
  dark blue colored and the Occultation Event number window beside is in-
  sensitive), all Occultation Events along the Air Plane Trajectory (APT)
  are calculated 'online', which takes some time before the pop-up window
  is ready for user inputs.
- The interesting geographic area can be enlarged with the Zoom Region
  option for a better recognition of the individual occultation events.


INPUT PARAMETER(S)

 1) === INPUT FIELD for Selection of Occultation Event ===

    Purpose:
       Allows to selection the Occultation Event by keyboard input.

    Type:
       Text input field for Occultation Event Number.

    Format/Usage:
```

```
      Put in the Selected Occultation Event Number. If you select
      an Occultation Event via mouse-click from the map, the chosen Occul-
      tation Event Number will be displayed in this text input window.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The actual range of possible values is shown in the information
      label to the right side of the input window.

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available.


2) === LABELS for Information on the Selected Occultation Event ===

   Purpose:
      Show all important Information like Occultation Event Type and
      Time, the GNSS-Id, Tangent Point-, GNSS-, and Airplane Positions
      (height, latitude, and longitude) about the chosen Occultation
      Event.

   Type:
      Label widgets for showing individual information texts.

   Format/Usage:
      ---

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


3) === DROPLIST for Geographic Area Setting ===

   Purpose:
      This droplist-button allows to select among four different Geo-
      graphic Areas Settings. For zooming, the droplist setting has to be
      set to 'Zoom Region'. This enables marking the rectangular zoom region
      with the zoom cursor (the left mouse button must be in pressed
      state to create the zoom frame; clicking the right mouse button
      afterwards enlarges the marked region).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following values: 'Global', 'Northern Hemisphere',
      'Southern Hemisphere', and 'Zoom Region'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always Available.


4) === BUTTON for Show rays ===

   Purpose:
```

```
      Allows to visualize part of the radio signal track near the tangent
      point between the GNSS-satellite and the receiver located on the
      airplane (two rays, one at the beginning and one at the end of the
      occultation event, are shown).

   Type:
      Button for showing part of the radio signal track.

   Format/Usage:
      Press the button to show part of the radio sigal track.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


5) === BUTTON for printing Plot Window content to PS file ===

   Purpose:
      The "To PS file ..." button opens a pop-up window for printing the
      whole content of the plot window into a PS-file for permanent storage.
      The name of the PS file, the size of the plot (DIN-A4 or letter for-
      mat) and the kind of PS plot file (standard or encapsulated PS) can
      be selected.

   Type:
      Button to open pop-up window for PS file output adjustments.

   Format/Usage:
      Press the button to open the "To PS file ..." pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


6) === BUTTON to Quit Occultation Event Selection Pop-up Window ===

   Purpose:
      Pressing the 'Quit' button causes the selected Occultation Event
      Number to be accepted as input (whereas pressing 'Cancel' means to
      drop the changes just made in this input window). After clicking
      'Quit', the Occultation Event Selection for Realistic Airborne
      Occultations Pop-up Window is closed.

   Type:
      Button for saving and closing the Occultation Event Selection for
      Realistic Airborne Occultations Pop-up Window.

   Format/Usage:
      Press the 'Quit' button to save the window content an close the
      Occultation Event Selection for Realistic Airborne Occultations
      Pop-up Window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
```

```
      Always Available.

INPUT EXAMPLE(S)

- Selecting Occultation Event Number 8 from the map:
   Click with the left mouse button on the occultation number 8 symbol
   in the plot window. Afterwards press the 'Quit' button to accept the
   former selection and to close the select pop-up window.
```

5.4.24 Print to PS File Input

5.4.24.1 PS File Output

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.9.1, titled "PS File Output" .

5.4.25 Atmosphere Model Input

5.4.25.1 GCM 3D Atmosphere

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.8.1, titled "GCM3D Atmosphere Data Path/File Selection" .

5.4.25.2 HiVRes Atmosphere

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.8.2, titled "HiVRes Atmosphere Data Path/File Selection" .

5.4.26 Gravity Wave Superposition Input

5.4.26.1 Geographic Domain of Gravity Wave Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- Disturbed Area is only sensitive in case of Ionosphere Disturbance Model.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
       For Atmosphere Disturbance Model no function.

    Type:
```

Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
The droplist is not available in case of Atmosphere Disturbance Model.

2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

Purpose:
Allows the input of the Disturbance Reference Location/Center (Location of Tangent Point of the Occultation Event at Hlo) by keyboard input.

Type:
Text input field for input of the Disturbance Reference Location/ Center string.

Format/Usage:
Put in first the Latitude and then the Longitude of the Tangent Point. One digit after the comma is allowed. Both values should be separated at least by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Latitude is constrained between -90.0 and 90.0 degrees,
Longitude is constrained between -180.0 and 180.0 degrees.

Notes on Values:

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
  Set input field to '54.6 -13.8'.

5.4.26.2 Gravity Wave Specifications

GENERAL DESCRIPTION

This input group allows to specify the Meridional Wavelength, the Zonal Wavelength, and the Maximum Relative Gravity Wave Amplitude.

SPECIAL NOTES/HINTS

-

INPUT PARAMETER(S)

1) === INPUT FIELD for Meridional Wavelength Choice ===

Purpose:
Allows the input of the Meridional Wavelength Choice by keyboard input.

```
    Type:
       Text input field for input of the Meridional Wavelength Choice.

    Format/Usage:
       Put in the Meridional Wavelength. Two digits after the comma are
       allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Meridional Wavelength is constrained between 0.10 and 3000.00 km.

    Notes on Values:
       Default is 500 km.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for  Zonal Wavelength Choice ===

    Purpose:
       Allows the input of the Zonal Wavelength Choice by keyboard input.

    Type:
       Text input field for input of the Zonal Wavelength Choice.

    Format/Usage:
       Put in the Zonal Wavelength. Two digits after the comma are
       allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Zonal Wavelength is constrained between 0.10 and 3000.00 km.

    Notes on Values:
       Default is 0 km.

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for Maximum Relative Gravity Wave Amplitude Choice ===

    Purpose:
       Allows the input of the Maximum Relative Gravity Wave Amplitude
       Choice by keyboard input.

    Type:
       Text input field for input of the Maximum Relative Gravity Wave
       Amplitude Choice.

    Format/Usage:
       Put in the Maximum Relative Gravity Wave Amplitude. One digit
       after the comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Maximum Relative Gravity Wave Amplitude is constrained between
       0.0 and 5.0 %.

    Notes on Values:
       Default is 2 %.

    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Select a Maximum Relative Gravity Wave Amplitude of 3.8 %:
```

```
   Set input field to '3.8'.
```

5.4.26.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.27 Frontal System Gradient Superposition Input

5.4.27.1 Geographic Domain of Frontal System Gradient Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- Disturbed Area is only sensitive in case of Ionosphere Disturbance Model.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
       For an Atmosphere Disturbance Model, no function.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

    Purpose:
       Allows the input of the Disturbance Reference Location/Center
       (Location of Tangent Point of the Occultation Event at Hlo) by
       keyboard input.

    Type:
       Text input field for input of the Disturbance Reference Location/
       Center string.

    Format/Usage:
       Put in first the Latitude and then the Longitude of the Tangent
       Point. One digit  after the comma is allowed. Both values should be
       separated at least by a blank.
       Press <CR> to deliver the input to the system.
```

```
    Range of Values:
       Latitude is constrained between -90.0 and 90.0 degrees,
       Longitude is constrained between -180.0 and 180.0 degrees.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
   Set input field to '54.6 -13.8'.
```

5.4.27.2 Frontal System Gradient Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Meridional Temperature Gradient,
the Zonal Temperature Gradient, and the Slope of the Front.


SPECIAL NOTES/HINTS

-


INPUT PARAMETER(S)

 1) === INPUT FIELD for Meridional Temperature Gradient Choice ===

    Purpose:
       Allows the input of the Meridional Temperature Gradient Choice
       by keyboard input.

    Type:
       Text input field for input of the Meridional Temperature
       Gradient Choice.

    Format/Usage:
       Put in the Meridional Temperature Gradient. One digit after the
       comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Meridional Temperature Gradient, constrained from 0.0 to
       10.0 K /100 km.

    Notes on Values:
       Default is 5 K/100 km.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for Zonal Temperature Gradient Choice ===

    Purpose:
       Allows the input of the Zonal Temperature Gradient Choice by
       keyboard input.

    Type:
       Text input field for input of the Zonal Temperature Gradient
       Choice.

    Format/Usage:
```

```
       Put in the Zonal Temperature Gradient. One digit after the comma
       is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Zonal Temperature Gradient, constrained from 0.0 to
       10.0 K/100 km.

    Notes on Values:
       Default is 0 K/100 km.

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for Slope of Front Choice ===

    Purpose:
       Allows the input of the Slope of Front Choice by keyboard input.

    Type:
       Text input field for input of the Slope of Front Choice.

    Format/Usage:
       Put in the Slope of Front. One digit after the comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Slope of the Front, constrained from 0.0 to 10.0 %.

    Notes on Values:
       Default is 5 %.

    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Selecting Slope of Front 4.8 %:
   Set input field to '4.8'.
```

5.4.27.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.28 Tropopause Fold Superposition Input

5.4.28.1 Geographic Domain of Tropopause Fold Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- Disturbed Area is only sensitive in case of Ionosphere Disturbance Model.
```

```
INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
       For the Atmosphere Disturbance Model, no function.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

    Purpose:
       Allows the input of the Disturbance Reference Location/Center
       (Location of Tangent Point of the Occultation Event at Hlo) by
       keyboard input.

    Type:
       Text input field for input of the Disturbance Reference Location/
       Center string.

    Format/Usage:
       Put in first the Latitude and then the Longitude of the Tangent
       Point. One digit after the comma is allowed. Both values should be
       separated at least by a blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Latitude is constrained between -90.0 and 90.0 degrees,
       Longitude is constrained between -180.0 and 180.0 degrees.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
   Set input field to '54.6 -13.8'.
```

5.4.28.2 Tropopause Fold Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Tropopause Fold Center Height, the
Tropopause Fold Vertical Width, and the Tropopause Fold Relative Density
Amplitude.


SPECIAL NOTES/HINTS

-
```

```
INPUT PARAMETER(S)

 1) === INPUT FIELD for Center Height of Fold Choice ===

    Purpose:
       Allows the input of the Tropopause Fold Center Height Choice
       by keyboard input.

    Type:
       Text input field for input of the Tropopause Fold Center Height
       Choice.

    Format/Usage:
       Put in the Tropopause Fold Center Height. One digit after the
       comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Tropopause Fold Center Height is constrained between 7.0 and
       25.0 km.

    Notes on Values:
       Default is 12 km.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for Vertical Width of Fold Choice ===

    Purpose:
       Allows the input of the Tropopause Fold Vertical Width Choice
       by keyboard input.

    Type:
       Text input field for input of the Tropopause Fold Vertical Width
       Choice.

    Format/Usage:
       Put in the Tropopause Fold Vertical Width. One digit after the
       comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Tropopause Fold Vertical Width is constrained between 100.0 and
       5000.0 m.

    Notes on Values:
       Default is 2000 m.

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for Relative Density Amplitude of Fold Choice ===

    Purpose:
       Allows the input of the Tropopause Fold Relative Density Amplitude
       Choice by keyboard input.

    Type:
       Text input field for input of the Tropopause Fold Relative Density
       Amplitude Choice.

    Format/Usage:
       Put in the Tropopause Fold Relative Density Amplitude. One digit
       after the comma is allowed.
       Press <CR> to deliver the input to the system.
```

```
    Range of Values:
       The Tropopause Fold Relative Density Amplitude is constrained
       between 0.0 and 4.0 %.

    Notes on Values:
       Default is 2 %.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Select a Tropopause Fold Relative Density Amplitude of 1.8 %:
   Set input field to '1.8'.
```

5.4.28.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.29 Atmospheric Inversion Superposition Input

5.4.29.1 Geographic Domain of Atmospheric Inversion Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- Disturbed Area is only sensitive in case of Ionosphere Disturbance Model.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
       For an Atmosphere Disturbance Model, no function.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===
```

```
    Purpose:
       Allows the input of the Disturbance Reference Location/Center
       (Location of Tangent Point of the Occultation Event at Hlo) by
       keyboard input.

    Type:
       Text input field for input of the Disturbance Reference Location/
       Center string.

    Format/Usage:
       Put in first the Latitude and then the Longitude of the Tangent
       Point. One digit after the comma is allowed. Both values should be
       separated at least by a blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Latitude is constrained between -90.0 and 90.0 degrees,
       Longitude is constrained between -180.0 and 180.0 degrees.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
   Set input field to '54.6 -13.8'.
```

5.4.29.2 Atmospheric Inversion Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Center Height of Inversion, of
the Vertical Width of Inversion, and of the Density Gradient due to
Inversion.


SPECIAL NOTES/HINTS

-


INPUT PARAMETER(S)

 1) === INPUT FIELD for Center Height of Inversion Choice ===

    Purpose:
       Allows the input of the Center Height of Inversion Choice
       by keyboard input.

    Type:
       Text input field for input of the Center Height of Inversion
       Choice.

    Format/Usage:
       Put in the Center Height of Inversion. One digit after comma
       is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Center Height of Inversion, constrained from 1.0 to 7.0 km.

    Notes on Values:
       Default is 5 km.

    Availability/Indirect Effects:
```

```
       Always available.


 2) === INPUT FIELD for Vertical Width of Inversion Choice ===

    Purpose:
       Allows the input of the Vertical Width of Inversion Choice by
       keyboard input.

    Type:
       Text input field for input of the Vertical Width of Inversion
       Choice.

    Format/Usage:
       Put in the Vertical Width of Inversion. One digit after comma
       is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Vertical Width of Inversion, constrained from 100.0 to
       5000 km.

    Notes on Values:
       Default is 2000 km.

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for Density Gradient due to Inversion Choice ===

    Purpose:
       Allows the input of the Density Gradient due to Inversion Choice
       by keyboard input.

    Type:
       Text input field for input of the Density Gradient due to
       Inversion Choice.

    Format/Usage:
       Put in the Density Gradient due to Inversion. One digit after
       the comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Density Gradient due to Inversion, constrained from
       0.0 to 4.0 %/km.

    Notes on Values:
       Default is 2 %/km.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting Density Gradient due to Inversion 2.8 %:
   Set input field to '2.8'.
```

5.4.29.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.30 TID Event Superposition Input

5.4.30.1 Geographic Domain of TID Event Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- TID is an acronym for Travelling Ionospheric Disturbance.
- The Disturbed Area is only available, if the projection of the line of
  sight between the GNSS and LEO satellites never reaches higher latitudes
  than +-80 deg.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
      Allows the selection between 'Area comprising full ray', 'Area
      comprising inbound ray - GNSS-to-Tang.Point' and 'Area comprising
      outbound ray - Tang.Point-to-LEO'.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Area comprising full ray', 'Area
       comprising inbound ray - GNSS-to-Tang.Point' or 'Area comprising
       outbound ray - Tang.Point-to-LEO'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model
       and if the projection of the line of sight between the GNSS and
       LEO reaches latitudes higher than +-80 deg.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

    Purpose:
       Allows the input of the Disturbance Reference Location/Center
       (Location of Tangent Point of the Occultation Event at Hlo) by
       keyboard input.

    Type:
       Text input field for input of the Disturbance Reference Location/
       Center string.

    Format/Usage:
       Put in first the Latitude and then the Longitude of the Tangent
       Point. One digit after the comma is allowed. Both values should be
       separated at least by a blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Latitude is constrained between -90.0 and 90.0 degrees,
```

```
      Longitude is constrained between -180.0 and 180.0 degrees.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.
```

INPUT EXAMPLE(S)

```
- Selecting Area comprising full ray:
   Set droplist to 'Area comprising full ray'.

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
   Set input field to '54.6 -13.8'.
```

5.4.30.2 TID Event Specifications

GENERAL DESCRIPTION

This input group allows to specify the Meridional and Zonal Wavelength, and the Maximum Relative TID Amplitude.

SPECIAL NOTES/HINTS

- TID is the acronym for Travelling Ionospheric Disturbances.

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for Meridional Wavelength Choice ===

    Purpose:
       Allows the input of the Meridional Wavelength Choice by
       keyboard input.

    Type:
       Text input field for input of the Meridional Wavelength Choice.

    Format/Usage:
       Put in the Meridional Wavelength. Three digits after the comma are
       allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Meridional Wavelength is constrained between 100 and 3000 km.
       It is also allowed to set the Meridional Wavelength to 0 km.

    Notes on Values:
       Default is 1000 km. It is not possible to use 0 km as Meridional
       Wavelength and 0 km as Zonal Wavelength at the same time.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for Zonal Wavelength Choice ===

    Purpose:
       Allows the input of the Zonal Wavelength Choice by keyboard
       input.

    Type:
       Text input field for input of the Zonal Wavelength Choice.

    Format/Usage:
       Put in the Zonal Wavelength. Three digits after the comma are
```

```
       allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Zonal Wavelength is constrained between 100 and 3000 km.
       It is also allowed to set the Zonal Wavelength to 0 km.

    Notes on Values:
       Default is 0 km. It is not possible to use 0 km as Zonal
       Wavelength and 0 km as Meridional Wavelength at the same
       time.

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for Maximum Relative TID Amplitude Choice ===

    Purpose:
       Allows the input of the Maximum Relative TID Amplitude Choice
       by keyboard input.

    Type:
       Text input field for input of the Maximum Relative TID
       Amplitude Choice.

    Format/Usage:
       Put in the Maximum Relative TID Amplitude. One digit after
       the comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Maximum Relative TID Amplitude is constrained between 0.0
       to 30.0 %.

    Notes on Values:
       Default is 10 %.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Select a Maximum Relative TID Amplitude of 14.8 %:
   Set input field to '14.8'.
```

5.4.30.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.31 Ionospheric Gradient Superposition Input

5.4.31.1 Geographic Domain of Ionospheric Gradient Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).
```

```
SPECIAL NOTES/HINTS

- The Disturbed Area is only available, if the projection of the line of
  sight between the GNSS and LEO satellites never reaches higher latitudes
  than +-80 deg.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
      Allows the selection between 'Area comprising full ray', 'Area
      comprising inbound ray - GNSS-to-Tang.Point' and 'Area comprising
      outbound ray - Tang.Point-to-LEO'.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Area comprising full ray', 'Area
       comprising inbound ray - GNSS-to-Tang.Point' or 'Area comprising
       outbound ray - Tang.Point-to-LEO'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model
       and if the projection of the line of sight between the GNSS and
       LEO reaches latitudes higher than +-80 deg.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

    Purpose:
       Allows the input of the Disturbance Reference Location/Center
       (Location of Tangent Point of the Occultation Event at Hlo) by
       keyboard input.

    Type:
       Text input field for input of the Disturbance Reference Location/
       Center string.

    Format/Usage:
       Put in first the Latitude and then the Longitude of the Tangent
       Point. One digit after the comma is allowed. Both values should be
       separated at least by a blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       Latitude is constrained between -90.0 and 90.0 degrees,
       Longitude is constrained between -180.0 and 180.0 degrees.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting Area comprising full ray:
   Set droplist to 'Area comprising full ray'.

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
```

Set input field to '54.6 -13.8'.

5.4.31.2 Ionospheric Gradient Specifications

GENERAL DESCRIPTION

This input group allows to specify the Meridional Gradient, the Zonal Gradient, and the Relative Disturbance of Mean.

SPECIAL NOTES/HINTS

-

INPUT PARAMETER(S)

1) === INPUT FIELD for Meridional Gradient Choice ===

Purpose:
Allows the input of the Meridional Gradient Choice by keyboard input.

Type:
Text input field for input of the Meridional Gradient Choice.

Format/Usage:
Put in the Meridional Gradient. One digit after the comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
Meridional Gradient is constrained between 0.0 and 100 %/10 deg.

Notes on Values:
Default is 10 %/10 deg.

Availability/Indirect Effects:
Always available.

2) === INPUT FIELD for Zonal Gradient Choice ===

Purpose:
Allows the input of the Zonal Gradient Choice by keyboard input.

Type:
Text input field for input of the Zonal Gradient Choice.

Format/Usage:
Put in the Zonal Gradient. One digit after the comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
Zonal Gradient is constrained between 0.0 and 100 %/10 deg.

Notes on Values:
Default is 0 %/10 deg.

Availability/Indirect Effects:
Always available.

3) === INPUT FIELD for Relative Disturbance of Mean Choice ===

Purpose:
Allows the input of the Relative Disturbance of Mean Choice by keyboard input.

```
    Type:
       Text input field for input of the Relative Disturbance of
       Mean Choice.

    Format/Usage:
       Put in the Relative Disturbance of Mean. One digit after the
       comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Relative Disturbance of Mean is constrained between -50.0
       and 100.0 %.

    Notes on Values:
       Default is 0 %.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Select a Relative Disturbance Mean of -44.8 %:
   Set input field to '-44.8'.
```

5.4.31.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.32 Ionospheric Trough Superposition Input

5.4.32.1 Geographic Domain of Ionospheric Trough Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- The Disturbed Area is only available, if the projection of the line of
  sight between the GNSS and LEO satellites never reaches higher latitudes
  than +-80 deg.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
      Allows the selection between 'Area comprising full ray', 'Area
      comprising inbound ray - GNSS-to-Tang.Point' and 'Area comprising
      outbound ray - Tang.Point-to-LEO'.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
```

```
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 3 values: 'Area comprising full ray', 'Area
      comprising inbound ray - GNSS-to-Tang.Point' or 'Area comprising
      outbound ray - Tang.Point-to-LEO'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is not available in case of Atmosphere Disturbance Model
      and if the projection of the line of sight between the GNSS and
      LEO reaches latitudes higher than +-80 deg.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

   Purpose:
      Allows the input of the Disturbance Reference Location/Center
      (Location of Tangent Point of the Occultation Event at Hlo) by
      keyboard input.

   Type:
      Text input field for input of the Disturbance Reference Location/
      Center string.

   Format/Usage:
      Put in first the Latitude and then the Longitude of the Tangent
      Point. One digit after the comma is allowed. Both values should be
      separated at least by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Latitude is constrained between -90.0 and 90.0 degrees,
      Longitude is constrained between -180.0 and 180.0 degrees.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


INPUT EXAMPLE(S)

- Selecting Area comprising full ray:
    Set droplist to 'Area comprising full ray'.

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
    Set input field to '54.6 -13.8'.
```

5.4.32.2 Ionospheric Trough Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Latitudinal Full Width, the
Longitudinal Full Width, and the Relative Depth of Trough Center.


SPECIAL NOTES/HINTS

-


INPUT PARAMETER(S)

 1) === INPUT FIELD for Latitudinal Full Width Choice ===
```

```
   Purpose:
      Allows the input of the Latitudinal Full Width Choice by
      keyboard input.

   Type:
      Text input field for input of the Latitudinal Full Width Choice.

   Format/Usage:
      Put in the Latitudinal Full Width. One digit after the comma is
      allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Latitudinal Full Width is constrained between 1.0 and 90.0 deg.

   Notes on Values:
      Default is 5 deg.

   Availability/Indirect Effects:
      Always available.


2) === INPUT FIELD for Longitudinal Full Width Choice ===

   Purpose:
      Allows the input of the Longitudinal Full Width Choice by
      keyboard input.

   Type:
      Text input field for input of the Longitudinal Full Width Choice.

   Format/Usage:
      Put in the Longitudinal Full Width. One digit after the comma is
      allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Longitudinal Full Width is constrained between from 1.0 and
      90.0 deg.

   Notes on Values:
      Default is 45 deg.

   Availability/Indirect Effects:
      Always available.


3) === INPUT FIELD for Relative Depth of Trough Center Choice ===

   Purpose:
      Allows the input of the Relative Depth of Trough Center Choice
      by keyboard input.

   Type:
      Text input field for input of the Relative Depth of Trough
      Center Choice.

   Format/Usage:
      Put in the Relative Depth of Trough Center. One digit after
      the comma is allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Relative Depth of Trough Center is constrained between
      -300.0 and 99.0 %.

   Notes on Values:
      Default is 90 %.

   Availability/Indirect Effects:
      Always available.
```

```
INPUT EXAMPLE(S)

- Select a Relative Depth of Trough Center of -167.3 %:
   Set input field to '-167.3'.
```

5.4.32.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.33 Ionospheric Storm Effect Superposition Input

5.4.33.1 Geographic Domain of Ionospheric Storm Effect Disturbance

```
GENERAL DESCRIPTION

This input group allows to specify the Disturbed Area of the radio
signal between the GNSS and LEO-satellite and to fix the Disturbance
Reference Location Center (Location of Tangent Point of the Occultation
Event at Hlo).


SPECIAL NOTES/HINTS

- The Disturbed Area is only available, if the projection of the line of
  sight between the GNSS and LEO satellites never reaches higher latitudes
  than +-80 deg.


INPUT PARAMETER(S)

 1) === DROPLIST for Disturbed Area Choice ===

    Purpose:
      Allows the selection between 'Area comprising full ray', 'Area
      comprising inbound ray - GNSS-to-Tang.Point' and 'Area comprising
      outbound ray - Tang.Point-to-LEO'.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Area comprising full ray', 'Area
       comprising inbound ray - GNSS-to-Tang.Point' or 'Area comprising
       outbound ray - Tang.Point-to-LEO'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is not available in case of Atmosphere Disturbance Model
       and if the projection of the line of sight between the GNSS and
       LEO reaches latitudes higher than +-80 deg.


 2) === INPUT FIELD for Disturbance Reference Location/Center Choice ===

    Purpose:
```

Allows the input of the Disturbance Reference Location/Center (Location of Tangent Point of the Occultation Event at Hlo) by keyboard input.

Type:
Text input field for input of the Disturbance Reference Location/ Center string.

Format/Usage:
Put in first the Latitude and then the Longitude of the Tangent Point. One digit after the comma is allowed. Both values should be separated at least by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Latitude is constrained between -90.0 and 90.0 degrees,
Longitude is constrained between -180.0 and 180.0 degrees.

Notes on Values:

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Selecting Area comprising full ray:
  Set droplist to 'Area comprising full ray'.

- Selecting Latitude of 54.6 and Longitude of -13.8 deg:
  Set input field to '54.6 -13.8'.

5.4.33.2 Ionospheric Storm Effect Specifications

GENERAL DESCRIPTION

This input allows to specify the Amplitude of Storm Effect.

SPECIAL NOTES/HINTS

-

INPUT PARAMETER(S)

1) === INPUT FIELD for Amplitude of Storm Effect Choice ===

Purpose:
Allows the input of the Amplitude of Storm Effect Choice by keyboard input.

Type:
Text input field for input of the Amplitude of Storm Effect Choice.

Format/Usage:
Put in the Amplitude of Storm Effect. One digit after the comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
Amplitude of Storm Effect is constrained between -75.0 and 300.0 %.

Notes on Values:
Default is 50 %.

```
    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Select an Amplitude of Storm Effect of 188 %:
   Set input field to '188'.
```

5.4.33.3 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.34 Batch Job Input

5.4.34.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

5.4.34.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.4.34.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

5.4.35 Batch Processing Information

5.4.35.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.4.35.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

5.4.35.3 Terminate Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

5.4.35.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

5.4.35.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

5.4.35.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

5.5 Observation System Modeling

5.5.1 Observation System Modeling

```
GENERAL DESCRIPTION

Observation System Modeling (OSMod), together with prior Forward Modeling
(FoMod), performs quasi-realistic simulation of observables, and related
required variables, of the GNSS occultation technique. The main observables
are time-tagged phase and amplitude measurements, obtained in real world by
tracking occulted GNSS signals with a LEO platform-mounted GNSS receiver
for atmospheric sounding (GRAS) during their set/rise through the atmosphere
imposed by the relative orbital motion of the GNSS and LEO satellites.

Observation System Modeling itself denotes the superposition of all sorts
of relevant physical and technical influences of the observation system
(antenna, receiver, platform, fiducial sites) on the "ideal" signal
(phase and amplitude data) arriving at the receiving antenna, and on
the "ideal" orbit data (GNSS and LEO positions and velocities).
In fact these "ideal" data are the output of Forward Modeling, a
necessary prerequisite to be performed before Observation System Modeling
can be done. [See "Help on Task - Help on Forward Modeling" for more
information on FoMod.]

Many of the effects of the observation system correspond to the "classical"
sort of instrumental errors (e.g., receiver noise), others are intrinsic
natural parts of the receiving system (e.g., effect of the antenna gain
pattern on the signal amplitude finally available). The most relevant
observation system effects to be modeled include precise orbit determination
(POD) errors, the antennae gain pattern, receiver noise, local multipath
(due to the platform structure in the vicinity of the antenna), and
differencing treatment/clocks precision. For the Realistic Receiving System
Simulator (RRSS), e.g., it is now possible to include Open-Loop (OL)
tracking.

Observation system modeling requires a considerable number of "free
input parameters" in a simulation tool in order to allow for a (realistic)
OSMod simulation of widely arbitrary GNSS occultation missions. (See the
section "OSMod INPUT PARAMETERS" below for an overview on the respective
functionality furnished by EGOPS. Details are found in the On-line Help
within the "OSMod Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and
validation of the simulation results available in order to carry out
simulation studies efficiently and in order to effectively comprehend and
interpret the results. (See the section "OSMod VISUALIZATION" below for a
```

crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize/Val. Profiles" entry of the "Help" menu. Details are found in the On-line Help within the "Visualize/Validate Profiles" interface window available via the "Visualize/Validate" menu.)

OSMod INPUT PARAMETERS

EGOPS allows to compute Observation System Modeling tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Observation System Modeling. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific OSMod task.

The "OSMod Input" window, available via the "Observation System Modeling" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a "Reference FoMod Task-id", providing for access to the input conditions and results of a prior FoMod task).

- Forward modeling occultation event(s) selection:
The Reference FoMod Task-id can be selected from the list of suitable FoMod tasks existing within the current Project. Also, in case a sample of events is available for the selected Reference FoMod task, the event number range (or individual event number) of desired event(s) within the available FoMod events are selectable.

- Receiver sampling rates:
Defaults are the FoMod sampling rates for the L1 and L2 frequency (one of 500 Hz, 250 Hz, 100 Hz, 50 Hz, 25 Hz, 10 Hz, 5 Hz, 1 Hz, 0.1 Hz; with L2 rate less equal L1 rate). A task with sampling rate greater than 50 Hz will not be available in the Inversion Retrieval (InRet) System later. For the Parameterized Receiving System Simulator the receiver's L1 rate needs be less or equal the FoMod L1 rate, and the receiver's L2 rate needs, in turn, be less or equal the receiver's L1 rate (For the Realistic Receiving System Simulator L1 must be equal L2 and the minimum sampling frequency is 10 Hz).

- Transmitter signal powers:
For transmitter signal powers, the L1-C/A and L2-P value can be adjusted (for a single reference FoMod task only the GPS or the GLON text input field will be active - depends on the chosen occultation - whereas for a sample reference FoMod task with GPS and GLONASS occultation events both input fields are active simultaneously).

- POD error modeling:
No POD errors, or use of a "kinematic" POD error model is provided. (The latter model mimics POD position errors mainly by considering radial GNSS and LEO position errors, POD velocity errors by considering along-ray velocity bias and drift errors (superposed to the "ideal" LEO velocity), and POD-induced excess phase errors by considering along-ray excess phase drift and acceleration errors incurred by along-ray velocity bias and drift errors.)

- Receiving system simulator type:
Between a parameterized- or a realistic receiving system simulator can be selected, with the following specifications (first for the parameterized- and second for realistic receiving system simulator):

For the parameterized receiver system simulator:

- Occultation antennae specifications:
Antennae pointing and pattern characteristics, including boresight direction, field-of-view width and shape, and antenna gain at boresight (at GPS/ L1 frequency), for "anti-velocity" looking and forward-looking antenna. The availability of a specific one of the antennae or of both depends on the type of occultation event(s) baselined via the selection of the Reference FoMod task (e.g., if a singe setting occultation event was baselined, only the "anti-velocity" antenna will be available).

- Receiver performance/noise modeling specifications:
No receiver noise, or Gaussian noise, or realistic performance/noise can

be selected, with the following specifications of the latter two:

- Gaussian noise model:
RMS (root-mean-square) value of the Gaussian phase noise (thermal noise).

- Realistic performance/noise model:
Loop bandwidth (single-sided), LEO antennae noise temperature, and the number of quantization levels in A/D conversion.

- Local multipath modeling specifications:
No local multipath, or sinusoidal local multipath, or multiple sines, or realistic local multipath can be selected, with the following specifications of the latter three:

- Sinusoidal multipath model:
Period of the phase error, amplitude of the phase error, and (initialization) amplitude of the phase error at the topmost height of the occultation event.

- Multiple sines model:
The same specifications as of the sinusoidal multipath model, but up to 4 individual sines can be chosen for calculation.

- Realistic multipath model:
Ratio of multipath signal to direct signal, and source location (i.e., reflection point) of the multipath signal in (spherical) antenna coordinates.

- Differencing treatment and clocks modeling specifications:
No differencing/perfect clocks, or no differencing/real clocks, or double differencing, or ground-based single differencing, or spacebased single differencing, with the following specifications of the latter four:

- No differencing/real clocks:
Relative stability of GNSS clock (assumed for the worst clock in case of no differencing with real clocks involved).

- Double differencing:
Relative stability of ground clock (assumed for the worst clock in case of double differencing), and atmospheric noise per ground-to-satellite link involved in the differencing (this noise considered as clock-like noise).

- Ground-based single differencing:
Relative stability of LEO clock (assumed for the worst clock in case of ground-based single differencing), and atmospheric noise per ground-to-satellite link involved in the differencing.

- Space-based single differencing:
Relative stability of LEO clock (assumed for the worst clock in case of space-based single differencing).

For the realistic receiving system simulator:

- GRAS antenna specifications - antenna pattern files:
The select button allows to choose between two different antenna pattern files. These antenna pattern characteristic files are valid for the "anti-velocity" looking antenna (only setting GPS events can be processed because the realistic receiving system simulator is a pure GPS receiver).

- Random number seed:
The integer value of the random number seed can be set between 0 and 100, whereas 0 denotes the system clock.

- Technical specifications:
Several different features are connected together under this formal name. The system noise temperature, the number of interfering GPS satellites, the implementation loss, the antenna internal loss and the interference misalign loss.

- Loop specifications:
For open-loop tracking two different atmosphere models are available (the Biexponential- or a SAE-Fit atmosphere model). But it is also possible to turn the open-loop tracking off. Also adjustable are the loop period values and the start time of the 2nd value.

- FLL specifications:
It allows to specify the stop time and the filter order for the Frequency-Locked Loop (FLL) of the realistic receiving system simulator.

- Filter Specifications:
Adjustment of the L1- and CA filter specification allows for each filter the selection of the filter type and order, of the bandwidth values and the start time of the 2nd value can be modified.

OSMod VISUALIZATION:

EGOPS provides for the visualization of results of Observation System Modeling tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for OSMod tasks, to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "observed excess phase" and "observed power", "observed" here in the sense of end-to-end simulated observables) as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different OSMod tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

5.6 Observation System Modeling Input

5.6.1 OSMod/Task-Id

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)

The OSMod/Task-id is the name and identification of the Observation System Modeling (OSMod) Task you are currently supplying the input for. It is the key identification means for EGOPS to separate all files relating to your current simulation activity (which will actually start when you go for Save&Compute in the bottom button row) from others with different inputs (which you will assign different Task-ids). In fact, all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Observation System Modeling will be saved in the /OSMod subdirectory of the /<Project-id> directory of your current Project. (Consult the "Help on Project/About Projects" entry at the menu level in case you need to learn what an EGOPS "Project" and "Project-id" are.)

```
SPECIAL NOTES/HINTS

- Assign your Task a "smart" Task-id which conveys some hint to you on
  what this Task is about. See it like choosing a good brief title for
  your Task. (Among other things, this is very helpful during the
  visualization/validation of your results, when your primary selector
  will be just the Task-id assigned here.)


INPUT PARAMETER(S)

 1) === INPUT FIELD for assigning a OSMod/Task-id ===

    Purpose:
       Allows the assignment of a OSMod/Task-id to your current
       Task by keyboard input.

    Type:
       Text input field for input of the Task-id string.

    Format/Usage:
       Supply an arbitrary alphanumeric string of up to 25 characters which
       may also contain hyphen or underline characters. Longer strings,
       intermediate blanks, or use of other characters are not allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All strings which are compliant with the above defined format.
       The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
       'LetslearnEGOPS' are recognized as different). You will be
       properly warned in case you choose a Task-id which already exists
       from prior work or by default.

    Notes on Values:
       Hint - Avoid strings which may blame, annoy, seize up, etc., your
       colleague(s), who may potentially work with the same EGOPS...

    Availability/Indirect Effects:
       Always available. Remember that the Task-id will be the key name
       throughout the entire EGOPS system for identifying your current Task.


 2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing OSMod/Task-id ===

    Purpose:
       Allows to select an existing Task-id out of all existing ones.
       (Most convenient in case a prior Task shall be re-run with only
       slight modification, which is typically a very frequent case.)

    Type:
       Pop-up Window which allows to select by mouse-click a string entry
       from a list of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only if more than one Task already exists (otherwise
       the only existing Task-id - OSModdefault - is autom. set and the
```

```
       button/select-list window is insensitive).


 3) ===  BUTTON/DELETE WINDOW for deleting existing OSMod/Task-ids ===========

    Purpose:
       Allows to select one (or more) existing Task-id (s) out of all
       existing ones for deleting (only the OSModdefault Task-id cannot
       be deleted). Specifically, all information relating to the chosen
       Observation System Modeling Task-id (s) will be deleted in the /OSMod
       subdirectory of the /<Project-id> directory of the currently open
       Project.

    Type:
       Pop-up Window which allows to select by mouse-click a string entry
       from a list of available entries for deleting.

    Format/Usage:
       Press the button which causes a special delete window to pop-up.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only if more than one Task already exists (otherwise
       the only existing Task-id - OSModdefault - is not allowed to
       delete and the delete window button is set insensitive).


INPUT EXAMPLE(S)

- Naming one of a series of OSMod Training Tasks:
   Set input field to 'LetsLearnEGOPS-3'
   (The button/select-list window need not be touched)

- Selecting an earlier Training Task of the above series:
   (The input field need not be touched)
   Select the Task-id 'LetsLearnEGOPS-2' by using the button/select-list window
```

5.6.2 Forward Modeling Occultation Event Selection

```
GENERAL DESCRIPTION

This input group allows to specify the Reference FoMod/Task-id, the
corresponding Infos on (that) Task, and the Occultation Number Range.


SPECIAL NOTES/HINTS

- It is possible to choose the Reference FoMod/Task-id by clicking the
  'Reference FoMod/Task-id...'-button and then to select one Task-id from
  the list or by directly putting in the name of the Reference FoMod/Task-id
  into the foreseen textfield.
- The Occultation Number Range input line is only sensitive, if the FoMod
  Occultation Event Simulation Type was set to 'Sample of Events/Realistic
  Geometry'.


INPUT PARAMETER(S)

 1) ===  BUTTON/SELECT-LIST WINDOW for selecting a Reference FoMod/Task-id ===

    Purpose:
       Allows to select an existing Task-id out of all existing ones.
       (Most convenient in case a prior Task shall be re-run with only
       slight modifications, which is typically a very frequent case.)
```

```
   Type:
      Pop-up Window which allows to select by mouse-click an entry
      from a list of available entries.

   Format/Usage:
      Press the button, which causes a select-list window to pop-up. Select
      by mouse-click a Task-id out of the available ones in the list (which
      is highlighted upon selection; note that a default is already set).
      Confirm your selection with "Ok" or choose "Cancel" to return
      without action.

   Range of Values:
      Any Task-id available in the list.

   Notes on Values:
      Note that general InRet atmosphere processing needs 1 Hz as minimum
      sampling rate, whereas for InRet atm. inverse fresnel transform cal-
      culations, at least 10 Hz is needed for computing. Therefore, only
      reference FoMod/Task-ids which fulfill these constraints can be used
      with the InRet processing tools later on. No special sampling
      frequency constraint exists for ionosphere processing.

   Availability/Indirect Effects:
      Available only, if more than one Task already exists (otherwise,
      the only existing Task-id - FoModdefault - is automatically selected
      and the button/select-list window is set insensitive).


2) === INPUT FIELD for assigning a FoMod/Task-id ===

   Purpose:
      Allows to assign a FoMod/Task-id to your current Task by keyboard
      input.

   Type:
      Text input field for input of the Task-id string.

   Format/Usage:
      Supply an arbitrary alphanumeric string of up to 25 characters which
      may also contain hyphen or underline characters. Longer strings,
      intermediate blanks, or use of other characters are not allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All strings which are compliant with the above defined format.
      The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
      'LetslearnEGOPS' are recognized as different). You will be
      properly warned in case you choose a Task-id which already exists
      from prior work or by default.

   Notes on Values:
      Hint - Avoid strings which may blame, annoy, seize up, etc., your
      colleague(s), who may potentially work with the same EGOPS...

   Availability/Indirect Effects:
      Always available. Remember that the Task-id will be the key name
      throughout the entire EGOPS system for identifying your current Task.


3) === Button for showing Infos on Task in ===

   Purpose:
      To show a brief summary of the whole input status of the Reference
      FoMod/Task-id input.

   Type:
      Pop-up Window which shows all entries of the Reference FoMod/Task-id
      input.

   Format/Usage:
```

Press the Button which causes a text window to pop-up.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Button is always available.

4) === INPUT FIELD for the input of the Occultation Number Range ===

Purpose:
Allows to manipulate the Occultation Number Range by keyboard input.

Type:
Text input field for input of the Occultation Number Range string.

Format/Usage:
Put in the Occultation Number Range or manipulate the individual numbers separately (be careful about the proper step size).
Press <CR> to deliver the input to the system.

Range of Values:
Depends one the occultation numbers in the corresponding FoMod/ FoMod/Task-id.sgd-file. These numbers will be always show in the explanation label (right of the input field).

Notes on Values:
Only integer numbers are allowed.

Availability/Indirect Effects:
Only available in case the FoMod Occultation Event Simulation Type is set to 'Sample of Events/Realistic Geometry'.

INPUT EXAMPLE(S)

- Selecting a Occultation Number Range of 1 10 3 (lo hi step):
  Set input field to '1 10 3'.

5.6.3 Receiver Sampling Rates

GENERAL DESCRIPTION

This input group allows to specify two or three (the number of active droplists depends on the settings of the corresponding FoMod/Task-id) different combinations of Receiver Sampling Rates at the Relevant GNSS Frequencies (i.e. the L1 Receiver Sampling Rate for GPS+GLON, the L2 Receiver Sampling Rate for the US GPS, and the L2 Receiver Sampling Rate for the Russian GLONASS GNSS System). At least two options are always available.

SPECIAL NOTES/HINTS

- L1/L2 are the 2 frequency bands used by the GPS(GLONASS) Systems.
- GNSS is the generic acronym for the Global Navigation Satellite System (comprising the two existing systems GPS and GLONASS).
- GPS is the US Global Positioning System.
- GLONASS is the Russian GLObal NAvigation Satellite System.
- Note that general InRet atmosphere processing needs 1 Hz as the minimum sampling rate, whereas for InRet atm. inverse fresnel transform calculations, at least 10 Hz is needed. Therefore, only OSMod/Task-ids that fulfill these constraints can be used by the InRet processing tools.

No special sampling frequency constraint for ionosphere processing exists.

INPUT PARAMETER(S)

1) === DROPLIST for L1/GPS+GLON Receiver Sampling Rates Choice ===

Purpose:
Allows to select among different L1/GPS+GLON Receiver Sampling Rates.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following values: '500 Hz', '250 Hz', '100 Hz', '50 Hz', '25 Hz', '10 Hz', '5 Hz', '1 Hz', '0.1 Hz'. The actual upper boundary is the same as the corresponding FoMod upper limit.

Notes on Values:
A Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per second.

Availability/Indirect Effects:
The droplist is always available.

2) === DROPLIST for L2/GPS Receiver Sampling Rates Choice ===

Purpose:
Allows to select among different L2/GPS Receiver Sampling Rates.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
In principle, the same as under item 1), but the upper boundary is the value of the L1/GPS+GLON Receiver Sampling Rate setting.

Notes on Values:
Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per second.

Availability/Indirect Effects:
Availability of the droplist depends on the corresponding FoMod/ Task-id settings (i.e. GPS/none means that the droplist L2/GPS is insensitive).

3) === DROPLIST for L2/GLON Receiver Sampling Rates Choice ===

Purpose:
Allows to select amongst different L2/GLON Receiver Sampling Rates.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
In principle the same as under item 1), but the upper boundary is the value of the L1/GPS+GLON Receiver Sampling Rate setting.

Notes on Values:
A Sampling Rate of '0.1 Hz' (0.1 Hertz) means 0.1 measuring points per second.

Availability/Indirect Effects:
Availability of the droplist depends on the corresponding FoMod/ Task-id settings (i.e. GLON/none means that the droplist L2/GLON is insensitive).

INPUT EXAMPLE(S)

- Selecting 1 Hz as L1/GPS+GLON OSMod Receiver Sampling Rate:
  Set droplists to '1 Hz'.

5.6.4 Transmitter Signal Powers

GENERAL DESCRIPTION

This input group allows to specify the L1/L2 Transmitter Signal Power of the GPS- and/or GLONASS-satellites. The input unit of the Transmitter Signal Power is [dBW].

SPECIAL NOTES/HINTS

- The input field for GPS(GLON) is only sensitive, if GPS(GLON) was chosen for the corresponding FoMod-calculation.

INPUT PARAMETER(S)

1) === INPUT FIELD for L1-C/A L2-P /GPS Transmitter Signal Powers ===

Purpose:
Allows to set the L1-C/A L2-P /GPS Transmitter Signal Power by keyboard input.

Type:
Text input field for input of the L1/L2 GPS Transmitter Signal Power values.

Format/Usage:
Put in the L1 and L2 GPS Transmitter Signal Power values. One digit after the comma is allowed (don't forget to separate the two values by a blank).
Press <CR> to deliver the input to the system.

Range of Values:
The Transmitter Signal Power is constrained between 15 and 30 /[dBW].

Notes on Values:
Default is 27(20) /[dBW] for L1(L2).

Availability/Indirect Effects:
Only available, if GPS was selected for the corresponding FoMod-Task-id.

2) === INPUT FIELD for L1-C/A L2-P /GLON Transmitter Signal Powers ===

Purpose:
Allows to set the L1-C/A L2-P /GLON Transmitter Signal Power by keyboard input.

Type:
Text input field for input of the L1/L2 GLON Transmitter Signal Power values.

```
    Format/Usage:
       Put in the L1 and L2 GLON Transmitter Signal Power values. One
       digit after comma is allowed (don't forget to separate the two
       values by a blank).
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Transmitter Signal Power is constrained between 15 and 30 /[dBW].

    Notes on Values:
       Default is 27(20) /[dBW] for L1(L2).

    Availability/Indirect Effects:
       Only available, if GLON was selected for the corresponding FoMod-
       Task-id.
```

INPUT EXAMPLE(S)

- Selecting 23.1 and 17.4 for L1-C/A L2-P /GLON:
  Set /GLON input field to '23.1 17.4'.

5.6.5 POD Errors Modeling

GENERAL DESCRIPTION

This droplist provides a choice of 'No POD Errors Modeling' or of a 'Kinematic POD Error Model'. Selecting the 'Kinematic POD Error Model' opens a pop-up window that allows to specify the Error Specs Type, the Radial Position Errors, and the Along-Ray Errors.

SPECIAL NOTES/HINTS

- POD is the acronym for "Precise Orbit Determination".
- In case of a "FoMod Airborne Reference Task-id", the POD Pop-up Window is not available.

INPUT PARAMETER(S)

```
 1) === DROPLIST for opening Kinematic POD Error Model Pop-up Window ===

    Purpose:
       Allows to select between "No POD Errors" and "Kinematic POD
       Error Modeling...". Selecting the Kinematic POD Error Model opens
       a window which allows to adjust the Error Specs Type, the Radial
       Position Errors, and the Along-Ray Errors.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values: 'No POD Errors' or 'Kinematic
       POD Error Modeling...'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       For airborne simulations, this droplist is not available.
```

INPUT EXAMPLE(S)

- Activating 'Kinematic POD Error Modeling...' pop-up window:
  Set droplist to 'Kinematic POD Error Modeling...'.

5.6.6 Receiving Simulator Type

GENERAL DESCRIPTION

This droplist allows to select between two different Receiving System Simulator Types. It is possible to choose the Parameterized Receiving System Simulator (a theoretical receiver model) or to use the Realistic Receiving System Simulator Type, which models the exact behaviour of the Austrian Aerospace GPS-Receiver (GLONASS signals cannot be received with this receiver).

SPECIAL NOTES/HINTS

- The Realistic Receiving System Simulator is only available, if the receiver sampling rate is a least 10 Hz and L2/GPS was used. Furthermore, L1 must be equal to L2 and the selected FoMod-occultation has to be a setting event.

INPUT PARAMETER(S)

1) === DROPLIST for Receiving System Simulator Type Choice ===

   Purpose:
      Allows to select between a Parameterized Receiving System Simulator (a theoretical receiver model) or the Realistic AAS GPS Receiving System Simulator.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'Parameterized Receiving System Simulator', or 'Realistic Receiving System Simulator'.

   Notes on Values:

   Availability/Indirect Effects:
      Always available.

INPUT EXAMPLE(S)

- Selecting the Austrian Aerospace GPS-Receiver Type:
  Set droplist to 'Realistic Receiving System Simulator'.

5.6.7 GRAS Antennae Specifications

GENERAL DESCRIPTION

If the Parameterized Receiving System Simulator is selected, pressing of an antenna button opens a pop-up window. This pop-up window allows to manipulate the technical antenna characteristics by changing the values for the Boresight direction, the Antenna Field of View, the Half-Power Beam Width (HPBW), and the Antenna Gain/boresight. For the Realistic Receiving System Simulator, the GRAS Antennae Specifications are stored in two different Antenna Pattern Files (they can be selected from a Pop-

```
up Window which appears after pressing the "GRAS-AVA*.apd..."-button).


SPECIAL NOTES/HINTS

- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".
- "-V antenna" denotes an antenna pointing towards the anti-velocity
  direction half-space of a satellite (backward viewing), "+V antenna"
  denotes pointing towards the velocity-direction half-space (forward
  viewing).
- "Half-Power Beam Width (HPBW)" denotes a beamwidth within which the
  antenna has a -3dB gain for acquiring an occultation event.
- At least one antenna must be used.
- GRAS-AVA means the GRAS Anti-Velocity Antenna.
- APD is the acronym for Antenna Pattern Data.


INPUT PARAMETER(S)

 1) === BUTTON for opening Antenna Pop-up Window ===

    Purpose:
       The window allows to manipulate the technical antenna characteris-
       tics by changing the values for the Boresight direction, the Antenna
       Field of View, the Half-Power Beam Width (HPBW), and the boresight
       Antenna Gain.

    Type:
       One button per antenna, for opening the Antenna Pop-up Window
       (if activated).

    Format/Usage:
       Press the opening-button to open the pop-up Window.

    Range of Values:
       One button as described above for the "-V antenna" (enabling
       simulation of setting occ. events), and one button for the
       "+V antenna" (enabling simulation of rising occ. events).

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Pop-up Window opening button is only available, if the Parameterized
       Receiving System Simulator was selected as receiving simulator type.
       Also the antenna had to be used in the corresponding FoMod- and MAnPl-
       Simulations.


 2) === BUTTON for opening the GRAS-AVA*.apd Pop-up Window ===

    Purpose:
       This Pop-up Window allows to select a GRAS-AVA*.apd file from
       the list (*.apd files are antenna pattern files).

    Type:
       Button for opening the GRAS-AVA*.apd Pop-up Window.

    Format/Usage:
       Press the opening-button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       This button is only available, if the Realistic Receiving System
       Simulator was selected as receiving simulator type.
```

```
 3) === INPUT FIELD for the input of the Random Number Seed value ===

    Purpose:
       Allows to specify the Random Number Seed value by keyboard input.

    Type:
       Text input field for input of the Random Number Seed value.

    Format/Usage:
       Put in the Random Number Seed value.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Random Number Seed value can be chosen between 0 and 100.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       This input field is only available, if the Realistic Receiving
       System Simulator is selected as receiving simulator type.


INPUT EXAMPLE(S)

- Activating '+V Antenna...' pop-up window:
   Click on the '+V Antenna...' button to open the +V Antenna Input pop-up
   window.
```

5.6.8 Receiver Performance Modeling

GENERAL DESCRIPTION

This input group allows to specify the Receiver Performance Modeling. There are 3 different choices (No Receiver Noise, the Gaussian Noise Model, and the Realistic Performance/Noise Model). For the Gaussian Noise Model, input of the Gaussian Phase Noise is necessary, whereas for the Realistic Performance/Noise Model, specification of the LEO Antenna Noise Temperature, of the Quantization Levels/A-D Conversion and of the Loop Bandwidth is required.

SPECIAL NOTES/HINTS

- The Gaussian Phase Noise input field is only sensitive, if the Gaussian Noise Model is selected.

INPUT PARAMETER(S)

```
 1) === DROPLIST for Receiver Performance Modeling Choice ===

    Purpose:
       Allows to select among No Receiver Noise, the Gaussian Noise
       Model, and the Realistic Performance/Noise Model.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'No Receiver Noise', 'Gaussian Noise
       Model', or 'Realistic Perf./Noise Model'.

    Notes on Values:
```

```
      'No Receiver Noise' denotes an ideally perfect noiseless receiver.
      'Gaussian Noise Model' implements Gaussian receiver noise
      characteristics.
      'Realistic Perf./Noise Model' simulates a more realistic receiver
      noise distribution.

   Availability/Indirect Effects:
      The droplist always available.


2) === INPUT FIELD for Gaussian Phase Noise (rms) Choice ===

   Purpose:
      Allows to set the Gaussian Phase Noise by keyboard input.

   Type:
      Text input field for input of the Gaussian Phase Noise value.

   Format/Usage:
      Put in the Gaussian Phase Noise value. One digit after the comma is
      allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Gaussian Phase Noise (rms) is constrained between 0.1 and 50.0 /mm.

   Notes on Values:
      Default is 1.0 /mm.

   Availability/Indirect Effects:
      Only available, if the Gaussian Noise Model is selected.


3) === INPUT FIELD for Loop Bandwidth (single-side) Choice ===

   Purpose:
      Allows to set the Loop Bandwidth by keyboard input.

   Type:
      Text input field for input of the Loop Bandwidth value.

   Format/Usage:
      Put in the Loop Bandwidth value. One digit after the comma is allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Loop Bandwidth (single-side) is constrained between
      0.1 and 50.0 /Hz.

   Notes on Values:
      Default is 10 /Hz.

   Availability/Indirect Effects:
      Only available, if the Realistic Perf./Noise Model is selected.


4) === INPUT FIELD for LEO Antennae Noise Temperature Choice ===

   Purpose:
      Allows to set the LEO Antennae Noise Temperature by keyboard input.

   Type:
      Text input field for input of the LEO Antennae Noise Temperature value.

   Format/Usage:
      Put in the LEO Antennae Noise Temperature value. One digit after the
      comma is allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The LEO Antennae Noise Temperature is constrained between
```

```
       10 and 500 /K.

    Notes on Values:
       Default is 250 /K.

    Availability/Indirect Effects:
       Only available, if the Realistic Perf./Noise Model is selected.


 5) === INPUT FIELD for Quantization Levels/A-D Conversion Choice ===

    Purpose:
       Allows to set the Quantization Levels/A-D Conversion by keyboard
       input.

    Type:
       Text input field for input of the Quantization Levels/A-D
       Conversion value.

    Format/Usage:
       Put in the Quantization Levels/A-D Conversion value. One digit
       after the comma is allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Quantization Levels/A-D Conversion numbers available
       are 2,3,4,8,16.

    Notes on Values:
       Default value is 4.

    Availability/Indirect Effects:
       Only available, if the Realistic Perf./Noise Model was selected.
```

INPUT EXAMPLE(S)

- Selecting Gaussian noise model:
  Set droplist to 'Gaussian Noise Model'.

- Selecting LEO Antennae Noise Temperature to 157.3 K:
  Set input field to '157.3'.

5.6.9 Local Multipath Modeling

GENERAL DESCRIPTION

This input group allows to specify the Local Multipath Modeling. There are 4 different choices (No Local Multipath, the Sinusodial Multipath Model, the Multiple Sines Model, and the Realistic Multipath Model).
For the Sinusodial Multipath Model and for the Multiple Sines Model, input of the Phase Error Period, of the Phase Error Amplitude, and of the Phase Error Amplitude/Topmost Ray is necessary. For the Realistic Multipath Model, specification of the Multipath to Direct Signal Ratio, and of the Multipath Source is required.

SPECIAL NOTES/HINTS

- The 'No Local Multipath' choice is only recommendable for quick overview OSMod calculations.
- For input of the Multiple Sines Model values, an own pop-up window with 12 separate input fields will be displayed.

INPUT PARAMETER(S)

 1) === DROPLIST for Local Multipath Modeling Choice ===

Purpose:
Allows to select among No Local Multipath, Sinusodial Multipath Model, Multiple Sines Model, and Realistic Multipath Model.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following 4 values: 'No Local Multipath', 'Sinusodial Multipath Model', 'Multiple Sines Model...', 'Realistic Multipath Model'.

Notes on Values:
'No Local Multipath' denotes an ideally perfect "straight-line" receiver.
'Sinusodial Multipath Model' implements a multipath model with sinusodial behavior.
'Multiple Sines Model...' sums up the phase error values of the individual sines (up to 4) of a multipath model with sinusodial behavior.
'Realistic Multipath Model' simulates a more realistic receiver multipath model.

Availability/Indirect Effects:
The droplist always available.

2) === INPUT FIELD for Phase Error Period Choice ===

Purpose:
Allows to set the Phase Error Period by keyboard input.

Type:
Text input field for input of the Phase Error Period value.

Format/Usage:
Put in the Phase Error Period value.
Press <CR> to deliver the input to the system.

Range of Values:
The Phase Error Period is constrained between 1 and 5000 /sec.

Notes on Values:
Default is 100 /sec.

Availability/Indirect Effects:
Only available, if Sinusodial Multipath Model is selected.

3) === INPUT FIELD for Phase Error Amplitude Choice ===

Purpose:
Allows to set the Phase Error Amplitude by keyboard input.

Type:
Text input field for input of the Phase Error Amplitude value.

Format/Usage:
Put in the Phase Error Amplitude value. One digit after comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
The Phase Error Amplitude is constrained between 0.1 and 50 /mm.

Notes on Values:
Default is 2.0 /mm.

Availability/Indirect Effects:
Only available, if Sinusodial Multipath Model was selected.

4) === INPUT FIELD for Phase Error Amplitude/Topmost Ray Choice ===

Purpose:
Allows to set the Phase Error Amplitude/Topmost Ray by keyboard input.

Type:
Text input field for input of the Phase Error Amplitude/Topmost Ray value.

Format/Usage:
Put in Phase Error Amplitude/Topmost Ray value. One digit after comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
The Phase Error Amplitude/Topmost Ray is constrained between 0 and 2.0 /mm.

Notes on Values:
Default is 0.0 /mm.

Availability/Indirect Effects:
Only available, if Sinusodial Multipath Model is selected.

5) === INPUT FIELD for Multipath to Direct Signal Ratio Choice ===

Purpose:
Allows to set the Multipath to Direct Signal Ratio by keyboard input.

Type:
Text input field for input of the Multipath to Direct Signal Ratio value.

Format/Usage:
Put in the Multipath to Direct Signal Ratio value. One digit after comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
The Multiple to Direct Signal Ratio is constrained between 0.1 and 10 /%.

Notes on Values:
Default is 1.0 /%.

Availability/Indirect Effects:
Only available, if Realistic Multipath Model is selected.

6) === INPUT FIELD for Multipath Source Choice ===

Purpose:
Allows to set the Multipath Source by keyboard input.

Type:
Text input field for input of the Multipath Source string.

Format/Usage:
Put in the Multipath Source string. Each of the 3 numbers should at least be separated by one blank. One digit after comma is allowed.
Press <CR> to deliver the input to the system.

Range of Values:
The Multipath Source string numbers are constrained between

```
       0 and 12 /m, -90 and 90 /deg, and between 0 and 360 /deg.

    Notes on Values:
       Default values are 1.5 80.0 210.0 /[m deg deg].

    Availability/Indirect Effects:
       Only available, if Realistic Multipath Model is selected.


INPUT EXAMPLE(S)

- Selecting realistic multipath model:
   Set droplist to 'Realistic Multipath Model'.

- Selecting Multipath Source to 9.2 -13.6 254.7 /[m deg deg]:
   Set input field to '9.2 -13.6 254.7'.
```

5.6.10 Difference Treatment & Clock Modeling

```
GENERAL DESCRIPTION

This input group allows to specify the Differencing Treatment & Clock
Modeling. There are 5 different choices (No Differencing/Perfect Clocks,
No Differencing/Real Clocks, Double Differencing, Groundbased Single
Differencing, and Spacebased Single Differencing).
The 'No Differencing/Real Clocks' selection requires as an additional input
the value of the Relative Stability/GNSS Clock. 'Double Differencing'
requires the Relative Stability/Ground Clock and the Atmospheric
Noise/Ground Link values. 'Groundbased Single Differencing' requires the
Relative Stability/LEO Clock and the Atmospheric Noise/Ground Link values.
'Spacebased Single Differencing' requires only the Relative Stability/LEO
Clock values as additional input.


SPECIAL NOTES/HINTS

- 1secAllan is a measure for the (atomic) clock stability.


INPUT PARAMETER(S)

 1) === DROPLIST for Differencing Treatment & Clock Modeling Choice ===

    Purpose:
       Allows to selecti between No Differencing/Perfect Clocks,
       No Differencing/Real Clocks, Double Differencing, Groundbased
       Single Differencing, and Spacebased Single Differencing.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 5 values: 'No Differencing/Perfect Clocks',
       'No Differencing/Real Clocks', 'Double Differencing', 'Groundb.
       Single Differencing', and 'Spaceb. Single Differencing'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist always available.


 2) === INPUT FIELD for Relative Stability/GNSS Clock (1sAllan) Choice ===
```

```
Purpose:
   Allows to set the Relative Stability/GNSS Clock (1sAllan) by keyboard
   input.

Type:
   Text input field for input of the Relative Stability/GNSS Clock value.

Format/Usage:
   Put in the Relative Stability/GNSS Clock value. Two digits after
   the comma are allowed.
   Press <CR> to deliver the input to the system.

Range of Values:
   The Relative Stability/GNSS Clock is constrained between
   0.01 and 50 /[1E-13].

Notes on Values:
   Default is 30 /[1E-13].

Availability/Indirect Effects:
   Only available, if No Differencing/Real Clocks is selected.


3) === INPUT FIELD for Relative Stability/Ground Clock (1sAllan) Choice ===

Purpose:
   Allows to set the Relative Stability/Ground Clock (1sAllan) by
   keyboard input.

Type:
   Text input field for input of the Relative Stability/Ground Clock
   value.

Format/Usage:
   Put in the Relative Stability/Ground Clock value. Two digits after
   the comma are allowed.
   Press <CR> to deliver the input to the system.

Range of Values:
   The Relative Stability/Grnd Clock is constrained between
   0.01 and 50 /[1E-13].

Notes on Values:
   Default is 0.01 /[1E-13].

Availability/Indirect Effects:
   Only available, if Double Differencing was selected.


4) === INPUT FIELD for Atmospheric Noise/Ground Link (1sAllan) Choice ===

Purpose:
   Allows to set the Atmospheric Noise/Ground Link (1sAllan) by
   keyboard input.

Type:
   Text input field for input of the Atmospheric Noise/Ground Link
   value.

Format/Usage:
   Put in the Atmospheric Noise/Ground Link value. Two digits after
   the comma are allowed.
   Press <CR> to deliver the input to the system.

Range of Values:
   The Atmospheric Noise/Ground Link is constrained between
   0.01 and 50 /[1E-13].

Notes on Values:
   Default is 1.00 /[1E-13].
```

```
    Availability/Indirect Effects:
       Only available, if Double Differencing or Groundbased Single
       Differencing is selected.


 5) === INPUT FIELD for Relative Stability/LEO Clock (1sAllan) Choice ===

    Purpose:
       Allows to set the Relative Stability/LEO Clock (1sAllan) by
       keyboard input.

    Type:
       Text input field for input of the Relative Stability/LEO Clock
       value.

    Format/Usage:
       Put in the Relative Stability/LEO Clock value. Two digits after
       the comma are allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Relative Stability/LEO Clock is constrained between
       0.01 and 50 /[1E-13].

    Notes on Values:
       Default is 1.00 /[1E-13].

    Availability/Indirect Effects:
       Only available, if Groundbased Single Differencing or Spacebased
       Single Differencing is selected.


INPUT EXAMPLE(S)

- Selecting spacebased single differencing:
   Set droplist to 'Spacebased Single Differencing'.

- Selecting Relative Stability/LEO Clock (1sAllan) to 5.30:
   Set input field to '5.30'.
```

5.6.11 Realistic Receiving System Simulator Technical Specifications

```
GENERAL DESCRIPTION

This input group allows to specify several technical specs of the Realistic
Receiving System Simulator, i.e. the system noise temperature, the number of
interfering GPS satellites,the implementation loss, the antenna internal loss
and the interference misalign loss.


SPECIAL NOTES/HINTS

- The allowed value ranges for implementation loss, antenna internal loss and
  interference misalign loss are the same (0 - 10/[dB]).


INPUT PARAMETER(S)

 1) === INPUT FIELD for input of the System Noise Temperature ===

    Purpose:
       Allows to set the System Noise Temperature by keyboard input.

    Type:
       Text input field for input of the System Noise Temperature.

    Format/Usage:
       Put in the System Noise Temperature.
       Press <CR> to deliver the input to the system.
```

```
   Range of Values:
      The System Noise Temperature value may be between 0 and 500 [K].

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available for the Realistic Receiving System Simulator.


2) === INPUT FIELD for input of the Number of interfering GPS Sats ===

   Purpose:
      Allows to specify the Number of interfering GPS Satellites by key-
      board input.

   Type:
      Text input field for input of the Number of interfering GPS Satel-
      lites.

   Format/Usage:
      Put in the Number of interfering GPS Satellites.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Number of interfering GPS Satellites may be between 0 and 12.

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available for the Realistic Receiving System Simulator.


3) === INPUT FIELD for input of the Implementation Loss ===

   Purpose:
      Allows to set the Implementation Loss by keyboard input.

   Type:
      Text input field for input of the Implementation Loss.

   Format/Usage:
      Put in the Implementation Loss.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Implementation Loss value may be between 0 and 10/[dB].

   Notes on Values:
      The default value is 2.0.

   Availability/Indirect Effects:
      Always available for the Realistic Receiving System Simulator.


4) === INPUT FIELD for input of the Antenna Internal Loss ===

   Purpose:
      Allows to set the Antenna Internal Loss by keyboard input.

   Type:
      Text input field for input of the Antenna Internal Loss.

   Format/Usage:
      Put in the Antenna Internal Loss.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Antenna Internal Loss value may be between 0 and 10/[dB].
```

```
    Notes on Values:
       The default value is 1.0.

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.


 5) === INPUT FIELD for input of the Interference Misalign Loss ===

    Purpose:
       Allows to set the Interference Misalign Loss by keyboard input.

    Type:
       Text input field for input of the Interference Misalign Loss.

    Format/Usage:
       Put in the Interference Misalign Loss.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Interference Misalign Loss value may be between 0 and 10/[dB].

    Notes on Values:
       The default value is 0.0.

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.


INPUT EXAMPLE(S)

- Selecting 4 interfering GPS satellites:
   Set the number of interfering GPS sats input field to '4'.
```

5.6.12 Realistic Receiving System Simulator Loop Specifications

```
GENERAL DESCRIPTION

This input group allows to adjust the different loop specifications of
the Realistic Receiving System Simulator (i.e. the loop period values and
the start time of the 2nd value). For open-loop tracking, two different
atmosphere models are available.


SPECIAL NOTES/HINTS

-  Pressing the "Include Open-Loop OL) Tracking" button activates the
   droplist for the atmosphere model choice.


INPUT PARAMETER(S)

 1) === INPUT FIELD for the input of the Loop Period Values ===

    Purpose:
       Allows to set the Loop Period Values by keyboard input.

    Type:
       Text input field for input of the Loop Period Values.

    Format/Usage:
       Put in the two Loop Period Values (the values must be separated
       by a blank).
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Loop Period Values can be 1, 10, or 100 [msec].
```

```
   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Always available for the Realistic Receiving System Simulator.


2) === INPUT FIELD for the input of the Start Time of 2nd Value ===

   Purpose:
      Allows to specify the Start Time of 2nd Value of the loop period
      values by keyboard input.

   Type:
      Text input field for input of the Start Time of 2nd Value.

   Format/Usage:
      Put in the Start Time of 2nd Value.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Start Time of 2nd Value may be between 0 and 1000 [sec].

   Notes on Values:
      One digit after the comma is allowed.

   Availability/Indirect Effects:
      Always available for the Realistic Receiving System Simulator.


3) === BUTTON for activating the Atmosphere Models Choice Droplist ===

   Purpose:
      This button allows to activate (deactivate) the Atmosphere Model
      Choice droplist.

   Type:
      Button for activating or deactivating the Atmosphere Models Choice
      droplist.

   Format/Usage:
      Press the button to activate (deactivate) the Atmosphere Models Choice
      droplist.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


4) === DROPLIST for Open-Loop Tracking Atmosphere Models Choice ===

   Purpose:
      Allows to select between two different atmosphere models for
      open-loop tracking.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following two values: 'Bi-expon. Atm.Model', or 'SAE-
      Fit Atm.Model'.
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       This droplist is available, if Include Open-Loop Tracking is selected.
```

INPUT EXAMPLE(S)

```
- Select 10 and 100 [msec] for the two loop period variables:
   Set the numbers of the input field to '10 100'.
```

5.6.13 Realistic Receiving System Simulator FLL Specifications

GENERAL DESCRIPTION

This input group allows to specify the stop time and the filter order of the Frequency-Locked Loop (FLL) of the Realistic Receiving System Simulator.

SPECIAL NOTES/HINTS

-

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for input of the Frequency-Locked Loop Stop Time ===

    Purpose:
       Allows to set the FLL Stop Time by keyboard input.

    Type:
       Text input field for input of the Stop Time.

    Format/Usage:
       Put in the FLL Stop Time.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The value of the Stop Time can be chosen between 0 and 200 [msec].

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.


 2) === DROPLIST for Frequency-Locked Loop Filter Order Choice ===

    Purpose:
       Allows to select among three different FLL Filter Orders.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following three values: '1', '2', or '3'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.
```

```
INPUT EXAMPLE(S)

- Select 50 [msec] as Frequency-Locked Loop Stop Time:
   Set the number of the FLL Stop Time input field to '50'.
```

5.6.14 Realistic Receiving System Simulator Filter Specifications

```
GENERAL DESCRIPTION

For the Realistic Receiving System Simulator, two different Filters are
used (the L1 Filter and the CA Filter). The RRSS Filter Specifications
can be modified after opening the correspondent Pop-up Window. These
Pop-up Windows can be activated by pressing the 'L1 Filter...' or the
'CA Filter...' button.


SPECIAL NOTES/HINTS

- CA is the acronym for "".


INPUT PARAMETER(S)

 1) === BUTTON for opening L1 Filter Pop-up Window ===

    Purpose:
       This window allows to manipulate the technical L1 Filter characteris-
       tics by changing the values for the Filter Type, the Filter Order, the
       Bandwidth Values, and the Start Time of the 2nd Value.

    Type:
       Button for opening the L1 Filter Pop-up Window.

    Format/Usage:
       Press the L1 Filter button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.


 2) === BUTTON for opening CA Filter Pop-up Window ===

    Purpose:
       This window allows to manipulate the technical CA Filter characteris-
       tics by changing the values for the Filter Type, the Filter Order, the
       Bandwidth Values, and the Start Time of the 2nd Value.

    Type:
       Button for opening the CA Filter Pop-up Window.

    Format/Usage:
       Press the CA Filter button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available for the Realistic Receiving System Simulator.
```

```
INPUT EXAMPLE(S)

- Activating 'CA Filter...' Pop-up Window:
   Click on the 'CA Filter...' button to open the CA Filter Input Pop-
   up Window.
```

5.6.15 Realistic Receiving System Simulator I/Q-Signal Data Files

```
GENERAL DESCRIPTION

This button allows to activate or deactivate the creation of I/Q-Signal
Data File(s) additionally to the standard Simulated Signal Data File(s).


SPECIAL NOTES/HINTS

-  The path to the I/Q-Signal data files (in the EGOPS installation
   directory) is .../EGOPS/<ProjectID>/OSMod/<TaskID>_<OccNum>.ssd-IQ .


INPUT PARAMETER(S)

 1) === BUTTON for activating creation of I/Q-Signal Data Files ===

    Purpose:
       This button allows to activate (deactivate) the creation of
       I/Q-Signal Data File(s).

    Type:
       Button for activating or deactivating the creation of I/Q-Signal
       Data File(s).

    Format/Usage:
       Press the button to activate (deactivate) the creation of
       I/Q-Signal Data File(s).

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Select creation of I/Q-Signal Data Files:
   Press the button 'Create also I/Q-Signal Data File(s)' .
```

5.6.16 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.6.17 Save & Compute

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.3, titled "Save & Compute" .

5.6.18 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

5.6.19 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

5.6.20 Save Input

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.4, titled "Save Input" .

5.6.21 Input Summary

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.3.1, titled "Input Summary" .

5.6.22 Delete OSMod-Tasks Input

5.6.22.1 Delete Task-Ids

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.5.1, titled "Delete Task-Ids" .

5.6.23 Kinematik POD Error Model Input

5.6.23.1 Error Specs Type

```
GENERAL DESCRIPTION

This input allows to select between 2 different Error Specs Types.
It is possible to select between Apply Error Specs as specified and
Apply Error Specs randomly (as rms).


SPECIAL NOTES/HINTS

- The Error Specs Type droplist is only sensitive in case Sample of
  Events/Realistic Geometry was selected as FoMod Occultation Event
  Simulation Type (for Single Event/Ideal or Realistic Geometry the
  droplist is fixed to Apply Error Specs as specified).


INPUT PARAMETER(S)

 1) === DROPLIST for Error Specs Type ===

    Purpose:
       Allows the selection between Apply Error Specs as specified and
       Apply Error Specs randomly (as rms).
```

```
    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Apply Error Specs as specified',
       'Apply Error Specs randomly (as rms)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available in case Sample of Events/Realistic
       Geometry was selected as FoMod Occultation Event Simulation Type.
```

INPUT EXAMPLE(S)

- Selecting apply error specs as specified:
   Set droplist to 'Apply Error Specs as specified'.

5.6.23.2 Radial Position Errors

GENERAL DESCRIPTION

This input group allows to specify the GNSS and LEOs Radial Position Errors.

SPECIAL NOTES/HINTS

The range of values for the GNSS and LEOs Radial Position Errors are depending on the chosen error specs type (error specs type selection is only possible, if sample of events/realistic geometry was selected as occultation event simulation type in the chosen reference FoMod/Task).

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for GNSS Radial Position Error ===

    Purpose:
       Allows to set the GNSS Radial Position Error by keyboard input.

    Type:
       Text input field for input of the GNSS Radial Position Error.

    Format/Usage:
       Put in the GNSS Radial Position Error with a maximum of two
       post-comma digits.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From -50 to 50 meters (0.20 m is default) for error specs type
       "Apply Error Specs as specified" or from 0 to 50 meters (with
       the same default) for "Apply Error Specs randomly (as rms)".

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for LEOs Radial Position Error ===
```

```
    Purpose:
       Allows to set the LEOs Radial Position Error by keyboard input.

    Type:
       Text input field for input of the LEOs Radial Position Error.

    Format/Usage:
       Put in the LEOs Radial Position Error with a maximum of two
       post-comma digits.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From -50 to 50 meters (0.30 m is default) for error specs type
       "Apply Error Specs as specified" or from 0 to 50 meters (with
       the same default) for "Apply Error Specs randomly (as rms)".

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting a LEOs radial position error of -3 m:
   Choose error specs type of Apply Error Specs as specified and set LEOs
   Radial Position Error input field to '-3'.
```

5.6.23.3 Along-Ray Errors

```
GENERAL DESCRIPTION

This input group allows to specify the Along-Ray Errors, i.e. the Along-Ray
Velocity Error and the Along-Ray Acceleration Error.


SPECIAL NOTES/HINTS

The range of values for the Along-Ray Velocity- and Acceleration Errors
are depending on the chosen error specs type (error specs type selection
is only possible, if sample of events/realistic geometry was selected as
occultation event simulation type for the chosen reference FoMod/Task).


INPUT PARAMETER(S)

 1) === INPUT FIELD for Along-Ray Velocity Error ===

    Purpose:
       Allows to set the Along-Ray Velocity Error by keyboard input.

    Type:
       Text input field for input of the Along-Ray Velocity Error.

    Format/Usage:
       Put in the number for the chosen Along-Ray Velocity Error
       with a maximum of two post-comma digits.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From -5 to 5 mm/s (0.05 mm/s is default) for error specs type
       "Apply Error Specs as specified" or from 0 to 5 mm/s (with the
       same default value) for "Apply Error Specs randomly (as rms)".

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
```

```
       Always available.


 2) === INPUT FIELD for Along-Ray Acceleration Error ===

    Purpose:
       Allows to set the Along-Ray Acceleration Error by keyboard input.

    Type:
       Text input field for input of the Along-Ray Acceleration Error.

    Format/Usage:
       Put in the number for the chosen Along-Ray Acceleration Error
       with a maximum of two post-comma digits.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From -10 to 10 um/s2 (micrometer per square second, 0.0 um/s2
       is default) for error specs type "Apply Error Specs as specified"
       or from 0 to 10 um/s2 (with the same default value) for "Apply
       Error Specs randomly (as rms)".

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting an along-ray acceleration error of -0.3 um/s2:
   Choose error specs type of Apply Error Specs as specified and set
   Along-Ray Acceleration Error input field to '-0.3'.
```

5.6.23.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.6.24 Antenna Input

5.6.24.1 Boresight

```
GENERAL DESCRIPTION

This input group allows to specify the Elevation and the Azimuth of
the GRAS antenna mounted on the LEO, in the antenna coordinate system.
The antenna coordinate system is a s/c (spacecraft) fixed cartesian
system having its Z axis pointing towards nadir, its X axis perpendicular
to this Z axis in the plane spanned by the s/c velocity vector and the
Z axis, and the Y axis completing a right-handed coordinate system.


SPECIAL NOTES/HINTS

- Note that an Elevation of 0 deg denotes an antenna boresight in the X-Y
  plane in antenna coordinates, the elevation increasing downwards (towards
  nadir, i.e. Z-axis).
- An Azimuth of 0 deg means a forward-looking, an Azimuth of 180 deg
  a backward-looking antenna, the azimuth increasing from X over Y.
- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".
```

INPUT PARAMETER(S)

1) === INPUT FIELD for Elevation ===

Purpose:
Allows to set the antenna boresight Elevation by keyboard input.

Type:
Text input field for input of the Elevation value.

Format/Usage:
Put in the numbers for the chosen Elevation with a maximum
of one post-comma digit.
Press <CR> to deliver the input to the system.

Range of Values:
Elevation, 0 to 60 deg (default 27.0 deg; this is approximately the
angle between local horizontal at the s/c position and
Earth's limb at a typical LEO orbit near 800 km).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

2) === INPUT FIELD for Azimuth ===

Purpose:
Allows to set the antenna boresight Azimuth by keyboard input.

Type:
Text input field for input of the Azimuth value.

Format/Usage:
Put in the numbers for the chosen Azimuth with a maximum
of one post-comma digit.
Press <CR> to deliver the input to the system.

Range of Values:
Azimuth, 90 to 270 deg for the "-V antenna" (default 0 deg),
-90 to 90 deg for the "+V antenna" (default 180 deg).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Selecting an Elevation input of 27.7 deg:
  Set Elevation input field to '27.7'.

5.6.24.2 Antenna Field of View

GENERAL DESCRIPTION

This input allows to select among different Antenna field-of-views (FOVs).
It is possible to select a Conical FOV, an Elliptical FOV/horizontally
Cartesian, or an Elliptical FOV/horizontally Earth shaped.
"Conical FOV" means that any power pattern isocontour of the antenna main lobe
corresponds to a circle so the FOV defined by this isocontour is a cone with
constant opening angle at all lobe azimuths. In short, the lobe is cone-shaped.
"Elliptical FOV/horiz. Cartesian" means that the lobe's isocontours are
(regular) ellipses corresponding to an elliptical lobe shape with different
opening angles in the horizontal and vertical. The term "horiz. Cartesian" is

```
added to distinguish this regular ellipse-shape from another shape called
"Elliptical FOV/horiz. Earth-shaped", which means a quasi-ellipse with the
horizontal axis distorted to follow the shape of the Earth surface as seen from
the LEO satellite.


SPECIAL NOTES/HINTS

---


INPUT PARAMETER(S)

 1) === DROPLIST for Antenna FOV ===

    Purpose:
       Allows to select between Conical- and two types of Elliptical
       Field of View (horizontally Cartesian and horiz. Earth shaped).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following three values: 'Conical FOV', 'Ellip. FOV/hor.
       Cartesian', 'Ellip. FOV/hor. Earth shaped'.

    Notes on Values:
       'Conical FOV', antenna lobe of conical/circular shape.
       'Ellip. FOV/hor. Cartesian', antenna lobe of elliptical shape.
       'Ellip. FOV/hor. Earth shaped', antenna lobe
       (quasi-ellipse with the horizontal axis distorted to follow the shape
       of the Earth surface as seen from the LEO).

    Availability/Indirect Effects:
       The droplist is always available.


INPUT EXAMPLE(S)

- Selecting conical field of view:
   Set droplist to 'Conical FOV'.
```

5.6.24.3 Half-Power Beam Width

```
GENERAL DESCRIPTION

This input group allows to specify the Horizontal- and Vertical
Half-Power Beam Width of a GRAS antenna mounted on the LEO(s).
The Horizontal/Vertical Half-Power Beam Width (HPBW) of an antenna
is the region corresponding to a -3dB threshold of the normalized
power pattern in the Horizontal/Vertical antenna direction.


SPECIAL NOTES/HINTS

- For a Conical FOV, any Half-Power contour is a circle, and only
  one HPBW input is necessary (horizontal HPBW = vertical HPBW).
- GRAS is the acronym for "GNSS Receiver for Atmospheric Sounding".


INPUT PARAMETER(S)

1,2) === INPUT FIELDS for setting the Half-Power Beam Widths ===

    Purpose:
```

Allows to select the Horizontal and Vertical Half-Power Beam Width (in two separate input fields) by keyboard input.

Type:
Text input fields for input of the Horizontal/Vertical Half-Power Beam Width values.

Format/Usage:
Put in the numbers for the chosen Half-Power Beam Width with a maximum of one post-comma digit.
Press <CR> to deliver the input to the system.

Range of Values:
Horizontal/Vertical Half-Power Beam Width (HPBW), 1.0 to 180.0 deg for 'Conical FOV' and 'Ellip. FOV/hor. Cartesian' (default is 90.0 deg in all 3 options). For 'Ellip. FOV/hor. Earth shaped', the Horizontal HPBW range is the same as above, The maximum Vertical HPBW is confined to half of the chosen Horizontal HPBW, whereas the minimum Vertical HPBW depends on the Horizontal HPBW (i.e. 1 deg for a Horizontal HPBW of 1 deg, 10 deg for a Horizontal HPBW of 90 deg and 30 deg for a Horizontal HPBW of 180 deg; cf. two linear functions with different derivatives between 1 and 90 deg and 90 to 180 deg define the lower limit for the Vertical HPBW).

Notes on Values:
Only numbers are allowed.
The values define the full width of the beam (e.g., 90 deg = +-45 deg about boresight).

Availability/Indirect Effects:
Horizontal HPBW input field is always available; vertical HPBW input field is insensitive in case of Conical FOV
(i.e. the horizontal HPBW is equal to the vertical HPBW).

INPUT EXAMPLE(S)

- Selecting 120 deg as horizontal HPBW input:
  Set Horizontal HPBW input field to '120'.

5.6.24.4 Antenna Gain

GENERAL DESCRIPTION

This input allows to specify the Antenna Gain/boresight (GPS/L1). The Antenna Gain denotes the antenna amplification for the received radio signal and is given in decibel (dB).

SPECIAL NOTES/HINTS

- The decibel scale is a logarithmic notation for the Antenna Gain.

INPUT PARAMETER(S)

1) === INPUT FIELD for the Antenna Gain/boresight ===

Purpose:
Allows to set the Antenna Gain by keyboard input.

Type:
Text input field for input of the Antenna Gain value.

Format/Usage:
Put in the numbers for the Antenna Gain value with a maximum of one post-comma digit.
Press <CR> to deliver the input to the system.

```
    Range of Values:
       Between 5 and 9 decibel.

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       The Antenna Gain field is always available.


INPUT EXAMPLE(S)

- Selecting 7.4 dB as Antenna Gain input:
   Set Antenna Gain input field to '7.4'.
```

5.6.24.5 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.6.25 Multiple Sines Model Input

5.6.25.1 Multiple Sines Multipath Model Specifications

```
GENERAL DESCRIPTION

This input group allows to specify the Multiple Sines Multipath Modeling.
Up to 4 individual sines can be chosen. The Multiple Sines Multipath
Model is using the same equations as the Sinusoidal Multipath Model. It
first calculates the start time for each phase error sinus curve and then
sums up the phase error values of the individual sines. For calculation
the input of the Phase Error Period, the Phase Error Amplitude, and the
Phase Error Amplitude/Topmost Ray is necessary.


SPECIAL NOTES/HINTS

- One to four individual sines can be chosen.


INPUT PARAMETER(S)

 1) === 4 INPUT FIELDS for Phase Error Period Choice ===

    Purpose:
       Allows to set the Phase Error Periods for the individual
       sines by keyboard input.

    Type:
       Text input fields for input of the Phase Error Period values.

    Format/Usage:
       Put in the Phase Error Period values.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Phase Error Period is constrained between 1 and 5000 /sec.

    Notes on Values:
       Default is 100 /sec.

    Availability/Indirect Effects:
       Always available.
```

```
2) === 4 INPUT FIELDS for Phase Error Amplitude Choice ===

   Purpose:
      Allows to set the Phase Error Amplitudes for the individual
      sines by keyboard input.

   Type:
      Text input fields for input of the Phase Error Amplitude values.

   Format/Usage:
      Put in the Phase Error Amplitude values. One digit after comma is
      allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Phase Error Amplitudes is constrained between 0.1 and 50 /mm.

   Notes on Values:
      Default is 2.0 /mm.

   Availability/Indirect Effects:
      Always available.


3) === 4 INPUT FIELDS for Phase Error Amplitude/Topmost Ray Choice ===

   Purpose:
      Allows to set the Phase Error Amplitude/Topmost Rays for
      the individual sines by keyboard input.

   Type:
      Text input fields for input of the Phase Error Amplitude/Topmost
      Ray values.

   Format/Usage:
      Put in Phase Error Amplitude/Topmost Ray values. One digit after
      comma is allowed.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The Phase Error Amplitude/Topmost Rays is constrained between
      0 and 2.0 /mm.

   Notes on Values:
      Default is 0.0 /mm.

   Availability/Indirect Effects:
      Always available.


4) === OK BUTTON for saving and closing the Pop-up Window ===

   Purpose:
      Pressing the 'OK' button causes all input field settings
      to be accepted as the current Multiple Sines Multipath Model
      input (whereas pressing 'Cancel' means to drop the changes just
      made in the input sub-window). After pressing 'OK', the Multiple
      Sines Multipath Model input window is closed.

   Type:
      User I/F: One button for saving and closing the Multiple Sines
      Multipath Model input window.

   Format/Usage:
      Press the OK-button to close the input window.

   Range of Values:
      ---
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting a Phase Error Amplitude for Sine #2 of 2.0 /[mm]:
   Set Phase Error Amplitude input field of Sine #2 to '2.0'.
```

5.6.26 L1/CA Filter Input

5.6.26.1 Filter Specifications

```
GENERAL DESCRIPTION

This Pop-up Window allows to specify several different Filter Specifications
for the Realistic Receiving System Simulator (RRSS). It allows to adjust the
L1/CA Filter characteristics by changing the values for the Filter Type, the
Filter Order, the Bandwidth Values, and the Start Time of the 2nd Value.


SPECIAL NOTES/HINTS

- SCD is the acronym for "Super Critically Damped".
- SUD is the acronym for "Standard Under Damped".


INPUT PARAMETER(S)

 1) === DROPLIST for RRSS L1/CA Filter Type Choice ===

    Purpose:
       Allows to select between two different Filter Types.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values: 'JPL-SCD' or 'JPL-SUD'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       This droplist is always available.


 2) === DROPLIST for RRSS L1/CA Filter Order Choice ===

    Purpose:
       Allows to select between three different Filter Orders.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
```

```
       One of the following three values: '1', '2' or '3'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       This droplist is always available.


 3) === INPUT FIELD for the input of the RRSS Filter Bandwidth Values ===

    Purpose:
       Allows to set the RRSS Filter Bandwidth Values by keyboard input.

    Type:
       Text input field for input of the Filter Bandwidth Values.

    Format/Usage:
       Put in the two RRSS Filter Bandwidth Values (the values must be
       separated by a blank).
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Filter Bandwidth Values can be set between 0.05 and 100 [Hz].

    Notes on Values:
       Two digits after the comma are allowed.

    Availability/Indirect Effects:
       Always available for the realistic receiving system simulator.


 4) === INPUT FIELD for the input of the Start Time of 2nd Value ===

    Purpose:
       Allows to specify the Start Time of 2nd Value of the loop period
       values by keyboard input.

    Type:
       Text input field for input of the Start Time of 2nd Value.

    Format/Usage:
       Put in the Start Time of 2nd Value.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The Start Time of 2nd Value can be chosen between 0 and 1000 [sec].

    Notes on Values:
       One digit after the comma is allowed.

    Availability/Indirect Effects:
       Always available for the realistic receiving system simulator.


INPUT EXAMPLE(S)

- Fix the Start Time of 2nd Value to 250 [sec]:
   Set the number of the Start Time of 2nd Value input field to '250'.
```

5.6.26.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.6.27 Batch Job Input

5.6.27.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

_5.6.27.2 OK_

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.6.27.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

5.6.28 Batch Processing Information

5.6.28.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.6.28.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

5.6.28.3 Terminate Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

5.6.28.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

5.6.28.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

5.6.28.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

5.7 Occultation Data Inversion/Retrieval

5.7.1 Occultation Data Inversion/Retrieval

```
GENERAL DESCRIPTION

Inversion/Retrieval of occultation data denotes the processing of simulated
or observed phase and amplitude data (supplemented by the necessary
geometrical information) typically via Doppler shifts and bending angles
down to quasi-vertical atmospheric profiles of refractivity, density,
pressure, temperature, and humidity.

This processing chain typically requires, sequentially, tools for ionospheric
correction and conversion of the "raw" excess phase observables to
neutral-atmospheric bending angle profiles, for inversion of bending
angle profiles into refractivity profiles ("Inverse Abel Transform"),
and for finally retrieving the atmospheric variables (e.g., temperature)
from refractivity. The air (in the troposphere) may be considered either
dry or moist in the last stage of this processing chain.

Another route of inversion (possible within EGOPS), directly leading from
the raw observables to refractivity, is "Inverse Fresnel Transform": This
method is CPU-expensive but exploits both phase and amplitude observables
to resolve small-scale structures in the troposphere (down to the 100 m
level), which are convolved in the observables due to atmosphericdiffraction.
For the "Inverse Abel Transform", the resolution is "diffraction-limited" at
the "Fresnel-scale" (being somewhat less than 1 km in the Earth's
troposphere).

Necessary prerequisites for inversion/retrieval are either simulated
observables, obtained by Observation System Modeling (OSMod) within EGOPS,
or genuine observed phase and amplitude data (from the GPS/MET experiment).
[See "Help on Task - Help on Observation System Modeling" for more
information on OSMod, and see, e.g., the WWW site "http://pocc.gpsmet.ucar.edu"
for more information on the GPS/MET experiment and the data obtained.]

Such occultation data inversion/retrieval requires a considerable number of
"free input parameters" in a simulation tool in order to allow for flexible
data processing of widely arbitrary simulated GNSS occultation missions as
well as for observed data. (See the section "InRet INPUT PARAMETERS" below
for an overview on the respective functionality furnished by EGOPS. Details
are found in the On-line Help within the "InRet Input" interface window
available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and
validation of the simulation results available in order to carry out
simulation studies efficiently and in order to effectively comprehend and
interpret the results. (See the section "InRet VISUALIZATION" below for a
crude overview on the respective functionality furnished by EGOPS. A refined
overview is given under the "Help on Visualize/Val. - Help on Visualize/Val.
Profiles" entry of the "Help" menu. Details are found in the On-line Help
within the "Visualize/Validate Profiles" interface window available via
the "Visualize/Validate" menu.)


InRet INPUT PARAMETERS

EGOPS allows to compute Occ. Data Inversion/Retrieval tasks taking into
```

account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Occultation Data Inversion/Retrieval. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific InRet task.

The "InRet Input" window, available via the "Occ. Data Inv./Retrieval" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including either the supply of a "Reference OSMod Task-id", providing for access to the input conditions and results of a prior OSMod task, or, alternatively, including the supply of a "GPS/MET data path", providing for access to User-prepared GPS/MET data files.)

- Type of occultation data to be processed:
Simulated data (prepared by prior OSMod tasks run within EGOPS), or GPS/MET data (prepared by the User in a directory to which at least read-access exists from the EGOPS installation; mandatory file format: the "UCAR Level 2 data" format).

  - Occultation event(s) selection in case of simulated data:
  Reference OSMod Task-id (to be selected from the list of suitable OSMod tasks existing within the current Project).
  Also, in case a sample of events is available for the selected Reference OSMod task, event number range (or individual event number) of desired event(s) within the available OSMod events.

  - Occultation event(s) selection in case of GPS/MET data:
  GPS/MET data path (full directory path of the directory where the desired GPS/MET data reside, e.g., /home/<usr>/gpsmet/level2/occ/95.294/).
  Also, in case a sample of events is available within the selected GPS/MET data directory, event number range (or individual event number) of desired event(s) within the available GPS/MET events.

- Choice of Retrieval Processing Specifications:
"General Atmospheric Processing" (default) for General Phase/Power-to-Refractivity Processing, or "Atmospheric Inverse Fresnel Transform", or "Ionosphere Processing", where the first selection allows the following further choices:

  - Choice of Bending Angle Retrieval Specifications:
  For bending angle retrieval, "IAP Differential Correction & Ionosphere Correction & Bending Angle Retrieval", "IMG/UoG Ionosphere Correction & Bending Angle Retrieval" (the latter being the default), "DMI Standard Ionosphere Correction & Bending Angle Retrieval", or "DMI Enhanced Ionosphere Correction & Bending Angle Retrieval".
  For IAP Diff. Corr. & Ion. Corr. & Bend. Angle Retrieval "No Diff. Correction", or "Backpropagation" is possible for the Diff. Correction Type (in case of "Backpropagation" the value of the Local Backpropagation Plane can be set). For IMG/UoG Ion. Corr. & Bend. Angle Retrieval and DMI Enhanced Ion. Corr. & Bend. Angle Retrieval the Ion. Correction Type can be varied between "Phase Correction" and "Bend. Angle Correction", whereas the Stat. Optimization Type can be chosen among "No Stat. Optimization", "Optimize invoking MSIS90_DMI", "Optimize invoking CIRA86aQ_UoG" in the first case and amongst "No Stat. Optimization", "Optimize using m+z BenA Search", and "Optimize using glob. BenA Search" in the latter case (for DMI Standard Ion. Corr. & Bend. Angle Retrieval both the Ion. Correction Type and the Stat. Optimization Type are insensitive).

  - Refractivity Profiles Retrieval Specifications:
  For the Refractivity Profiles Retrieval/Inversion Tool, "No Atmospheric Refractivity Profiles Retrieval", or "DMI Abel Transform Atmos. Refractivity Profiles Retrieval" are possible.

  - Retrieval tools in case of Atmospheric Inverse Fresnel Transform:
  For Atm. Inverse Fresnel Transform the Bending Angle Retrieval Tool is n/a and the Ion. Correction Type and the Stat. Optimization Type are also insensitive. The only allowed Refractivity Profiles Retrieval/Inversion Tool is "DMI Inverse Fresnel Refractivity Profiles Retrieval".

  - Retrieval tools in case of Ionosphere Processing:
  For Ionosphere Processing the Bending Angle Retrieval Tool is constrained to "DMI Ionospheric Bending Angle Retrieval" and the Ion. Correction Type and the Stat. Optimization Type are insensitive. For the Refractivity Pro-

files Retrieval/Inversion Tool "No Ionospheric Refractivity Profiles Retrieval" or "DMI Abel Transform Ionos. Refractivity Profiles Retrieval" is allowed.

- Choice of Atmospheric Profiles Retrieval Specifications:

  - For the type of Atmospheric Profile Retrieval Tool: "No atmospheric profiles retrieval", or "DMI dry air profiles retrieval" (basic default), or "DMI/IMG moist air profiles retrieval", where the latter selection allows the following further choices:

  - For the type of moist air retrieval: "q,e,p,rho w. T prescribed (It)", or "q,e,p,rho w. T prescribed (In)", "q,e,rho with p,T prescribed", or "T,e,p,rho w. q prescribed (In)", or "T,e,rho with p,q prescribed", or "T,q,e,p,rho by Opt.Estimation...". The last one opens a pop-up window for the input of the Observation + ForwardModeling error covariance matrix specs and the background (T,q) error covariance matrix specifications.

  - Atmospheric model used for prescribed parameters: "FoMod atmosphere" (default in case of simulated data, meaning the atmosphere used in the "forward modeling" of the simulated observables), or "Bi-Exponential atmosphere", or "HLat 2D Atmosphere (CIRA86aQ_UoG)" (default in case of GPS/MET data), or the "GCM 3D Atmosphere (GCM3DAtm)", or the "HiVRes Atmosphere (HiVResAtm)...", or a "(Moist) User-supplied Atmosphere" (if moist air included in this atmosphere). [If you have a source-code version of EGOPS read the file usratm.SampleFile in the /prog/FORprog subdirectory of EGOPS in case you want to learn more about how to supply your own user supplied atmosphere.]

- Choice of Ionospheric Profiles Retrieval Specifications (only possible in case of Ionosphere Processing):

  - For the Ionospheric Profile Retrieval Tool: "No Ionosphere Profiles Retrieval", or "Electron Density Profiles Retrieval" are possible for selection.

InRet VISUALIZATION

EGOPS provides for the visualization of results of Occ. Data Inversion/Retrieval tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for InRet tasks, to post-process, validate against reference data, visualize, customize, compare, and print-out simulated or observed Doppler shift profiles (as function of occ. event time), bending angle profiles (as function of impact parameter), and refractivity, density, pressure, temperature, water vapor, and specific humidity profiles (as function of height). Also, in case of GPS/MET data, the original phase and amplitude data can be visualized (as function of occ. event time). The GPS/MET excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different InRet tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.
Furthermore, reference "ground-truth" profiles of refractivity, density, pressure, temperature, water vapor, and specific humidity can be prepared with any available atmospheric model within EGOPS, at the tangent point locations of the retrievals. Absolute and relative difference profiles w.r.t. these reference profiles can then be computed, as well as difference profiles statistics (mean difference to "ground-truth" and standard deviations compared to "ground-truth") for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of

a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

5.8 Occultation Data Inversion/Retrieval Input

5.8.1 InRet/Task-Id

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)

The InRet/Task-id is the name and identification of the Occultation Data Inversion/Retrieval (InRet) Task you are currently supplying the input for. It is the key identification means for EGOPS to separate all files relating to your current simulation activity (which will actually start when you go for Save&Compute in the bottom button row) from others with different inputs (which you will assign different Task-ids). In fact all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Occultation Data Inversion/Retrieval will be saved in the /InRet subdirectory of the /<Project-id> directory of your current Project. (Consult the "Help on Project/About Projects" entry at the menu level in case you need to learn what an EGOPS "Project" and "Project-id" are.)

SPECIAL NOTES/HINTS

- Assign your Task a "smart" Task-id which conveys some hint to you on what this Task is about. See it like choosing a good brief title for your Task. (Among other things, this is very helpful during the visualization/validation of your results, when your primary selector will be just the Task-id assigned here.)

INPUT PARAMETER(S)

1) === INPUT FIELD for assigning a InRet/Task-id ===

   Purpose:
      Allows the assignment of an InRet/Task-id to your current Task by keyboard input.

   Type:
      Text input field for input of the Task-id.

   Format/Usage:
      Supply an arbitrary alphanumeric string of up to 25 characters which may also contain hyphen or underline characters. Longer strings, intermediate blanks, or use of other characters are not allowed. Press <CR> to deliver the input to the system.

   Range of Values:
      All strings which are compliant with the above defined format. The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and 'LetslearnEGOPS' are recognized as different). You will be properly warned in case you choose a Task-id which already exists from prior work or by default.

   Notes on Values:
      Hint - Avoid strings which may blame, annoy, seize up, etc., your colleague(s), who may potentially work with the same EGOPS...

```
    Availability/Indirect Effects:
       Always available. Remember that the Task-id will be the key name
       throughout the entire EGOPS system for identifying your current Task.


 2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing InRet/Task-id ===

    Purpose:
       Allows to select an existing Task-id out of all existing ones.
       (Most convenient in case a prior Task shall be re-run with only
       slight modifications, which is typically a very frequent case.)

    Type:
       Pop-up Window which allows to select by mouse click a string entry
       from a list of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only if more than one Task already exists (otherwise
       the only existing Task-id - InRetdefault - is automatically selected
       and the button/select-list window is set insensitive).


 3) ===  BUTTON/DELETE WINDOW for deleting existing InRet/Task-ids ===========

    Purpose:
       Allows to select one (or more) existing Task-id (s) out of all
       existing ones for deleting (only the InRetdefault Task-id cannot
       be deleted). Specifically, all information relating to the chosen
       Mission/Analysis Planning Task-id (s) will be deleted in the /InRet
       subdirectory of the /<Project-id> directory of the currently open
       Project.

    Type:
       Pop-up Window which allows to select by mouse click a string entry
       from a list of available entries for deleting.

    Format/Usage:
       Press the button which causes a special delete window to pop-up.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise,
       the only existing Task-id - InRetdefault - is not allowed to be
       deleted and the delete window button is set insensitive).


INPUT EXAMPLE(S)

- Naming one of a series of InRet Training Tasks:
    Set input field to 'LetsLearnEGOPS-3'
    (The button/select-list window need not be touched)

- Selecting an earlier Training Task of the above series:
```

```
   (The input field need not be touched)
   Select the Task-id 'LetsLearnEGOPS-2' by using the button/select-list window
```

5.8.2 Occultation Data Type

```
GENERAL DESCRIPTION

This input allows to spelect amongst 3 different Occultation Data Types.
For every simulation type, the corresponding input window will be mapped
in the framed section below the Occultation Data Type droplist.


SPECIAL NOTES/HINTS

-


INPUT PARAMETER(S)

 1) === DROPLIST for Occultation Data Type ===

    Purpose:
       Allows the selection amongst Simulated Data, GPS/MET Data, and
       OERSTED/GPS Data.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'Simulated Data', 'GPS/MET Data',
       and 'OERSTED/GPS Data'.

    Notes on Values:
       If droplist is set to OERSTED/GPS Data, the OER/GPS Occultation
       Data Selection input area will be insensitive.

    Availability/Indirect Effects:
       The droplist is always available.


INPUT EXAMPLE(S)

- Selecting GPS/MET data:
   Set droplist to 'GPS/MET Data'.
```

5.8.3 OSMod Occultation Data Selection

```
GENERAL DESCRIPTION

This input group allows to specify the Reference OSMod/Task-id, the
corresponding Infos on (that) Task, and the Occultation Number Range.


SPECIAL NOTES/HINTS

- It is possible to choose the Reference OSMod/Task-id by clicking the
  'Reference OSMod/Task-id...'-button and to select a Task-id from the
  list or by directly putting in the name of the Reference OSMod/Task-id
  into the foreseen textfield.
- The Occultation Number Range input line is only sensitive, if the
  corresponding FoMod Occultation Event Simulation Type was set to 'Sample
  of Events/Realistic Geometry'.
```

```
INPUT PARAMETER(S)

 1) ===  BUTTON/SELECT-LIST WINDOW for selecting a Reference OSMod/Task-id ===

    Purpose:
       Allows to select an existing Task-id out of all existing ones.
       (Most convenient in case a prior Task shall be re-run with only
       slight modifications, which is typically a very frequent case.)

    Type:
       Pop-up Window which allows to select an entry from a list of
       available entries by mouse-click.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "OK" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       Only OSMod/Task-ids which fulfill the height range limits for
       atmospheric (ionospheric) calculations (Hlo between 0 and 30 km
       (0 and 200 km), Hhi between 70 to 120 km (500 km to the lowest
       perigee of the chosen LEO-satellites)) are shown in the list.
       Note that general InRet atmosphere processing needs 1 Hz as mini-
       mum sampling rate, whereas for InRet atm. inverse fresnel transform,
       at least 10 Hz sampling rate is needed for computing. Therefore, only
       reference OSMod/Task-ids which fulfill these constraints can be used
       with the InRet processing tools later on. For ionosphere processing,
       no special sampling frequency constraints exist.

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise
       the only existing Task-id - OSModdefault - is automatically selected
       and the button/select-list window is set insensitive).


 2) === INPUT FIELD for assigning a OSMod/Task-id ===

    Purpose:
       Allows the assignment of a OSMod/Task-id to your current
       Task by keyboard input.

    Type:
       Text input field for input of the Task-id string.

    Format/Usage:
       Supply an arbitrary alphanumeric string of up to 25 characters which
       may also contain hyphen or underline characters. Longer strings,
       intermediate blanks, or use of other characters are not allowed.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All strings which are compliant with the above defined format.
       The evaluation is case-sensitive (e.g., 'LetsLearnEGOPS' and
       'LetslearnEGOPS' are recognized as different). You will be
       properly warned in case you choose a Task-id which already exists
       from prior work or by default.

    Notes on Values:
       Hint - Avoid strings which may blame, annoy, seize up, etc., your
       colleague(s), who may potentially work with the same EGOPS...

    Availability/Indirect Effects:
       Always available. Remember that the Task-id will be the key name
       throughout the entire EGOPS system for identifying your current Task.
```

```
 3) === Button for showing Infos on Task in ===

    Purpose:
       To show a brief summary of the whole input status of the Reference
       OSMod/Task-id input.

    Type:
       Pop-up Window which shows all entries of the Reference OSMod/Task-id
       input.

    Format/Usage:
       Press the Button which causes a text window to pop-up.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Button is always available.


 4) === INPUT FIELD for the input of the Occultation Number Range ===

    Purpose:
       Allows to manipulate the Occultation Number Range by keyboard
       input.

    Type:
       Text input field for input of the Occultation Number Range.

    Format/Usage:
       Put in the Occultation Number Range or manipulate the individual
       numbers separately (be careful about the proper step size).
       Press <CR> to deliver the input to the system.

    Range of Values:
       Depends one the occultation numbers in the corresponding OSMod/
       OSMod/Task-id.sgd-file. These numbers will be always shown in the
       explanation label (right of the input field).

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Only available in case of FoMod Occultation Event Simulation Type
       was set to 'Sample of Events/Realistic Geometry'.


INPUT EXAMPLE(S)

- Selecting an Occultation Number Range of 1 10 3 (lo hi step):
   Set input field to '1 10 3'.
```

5.8.4 GPS/MET Occultation Data Selection

GENERAL DESCRIPTION

This input group allows to specify the GPS/MET Data Path and the Occultation Number Range.

SPECIAL NOTES/HINTS

- The default GPS/MET Data Path is set to the user's home directory.
- The Occultation Number Range input line is only sensitive, if the

```
  corresponding FoMod Occultation Event Simulation Type was set to
  'Sample of Events/Realistic Geometry'.

INPUT PARAMETER(S)

 1) === INPUT FIELD for input of the GPS/MET Data Path ===

    Purpose:
       Allows the specification of the GPS/MET Data Path by keyboard
       input.

    Type:
       Text input field for input of the GPS/MET Data Path.

    Format/Usage:
       Put in the GPS/MET Data Path. The default GPS/MET Data Path is
       set to the user's home directory.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


 2) === INPUT FIELD for input of the Occultation Number Range ===

    Purpose:
       Allows to manipulate the Occultation Number Range by keyboard
       input.

    Type:
       Text input field for input of the Occultation Number Range
       string.

    Format/Usage:
       Put in the Occultation Number Range or manipulate the individual
       numbers separately (be careful about the proper step size).
       Press <CR> to deliver the input to the system.

    Range of Values:
       Depends one the occultation numbers in the corresponding GPS/MET
       data files. These numbers will be always shown in the explanation
       label (right of the input field).

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Always available (in case of step size is equal to zero, the Occ.
       No. Range input field will be set insensitive). The occultation
       numbers and step size shown in the input field depends on the
       content of chosen GPS/MET data file.


INPUT EXAMPLE(S)

- Selecting GPS/MET Data Path of /home/usr/data/GPSMET/:
   Set input field to '/home/usr/data/GPSMET/'.
```

5.8.5 Retrieval Processing Specifications

GENERAL DESCRIPTION

These three exclusive buttons allow to select among General Atmosphere Processing, Atmosphere Inverse Fresnel Transform or Ionosphere Processing. General Atmosphere Processing allows to choose between different Bending Angle Retrieval Tools, Ionosphere Correction Types, and Statistical Optimization Types (for Atmosphere Inverse Fresnel Transform, not all of them are active or sensitive). Ionosphere Processing allows only one Bending Angle Retrieval Tool.

SPECIAL NOTES/HINTS

- Note that general InRet atmosphere processing needs 1 Hz as minimum sampling rate, whereas for InRet atm. inverse fresnel transform calculations, at least 10 Hz is needed for computing. Therefore, only reference OSMod/Task-ids which fulfill these constraints can be used for calculations with the InRet processing tools. It depends on the used sampling frequencies in the chosen reference OSMod/Task-id, if (in case of atmospheric processing) a selection between general atmosphere processing or atm. inverse fresnel processing is available. If the sampling rate was only 0.1 Hz, no choice is offered. No special sampling frequency constraint for ionosphere processing exists.

INPUT PARAMETER(S)

1) === BUTTON for selecting General Atmosphere Processing ===

Purpose:
Allows to select among 4 Bending Angle Retrieval Tools.

Type:
Exclusive button.

Format/Usage:
Press the button to selection one of the 4 Bending Angle Retrieval Tools.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Only available for atmosphere processing, if the sampling rates were at least 1 Hz and the height levels Hlo and Hhi were set (in the selected reference OSMod/Task-id) within the allowed limits for atmospheric calculations (Hlo between 0 and 30 km and Hhi between 70 and 120 km).

2) === BUTTON for selecting Atmosphere Inverse Fresnel Transform ===

Purpose:
Allows only Inverse Fresnel Refractivity Profiles Retrieval.

Type:
Exclusive button.

Format/Usage:
Press the button which causes to fix the Refractivity Profiles Retrieval/Inversion Tools droplist to DMI Inverse Fresnel Refractivity Profiles Retrieval.

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available for atmosphere processing, if the sampling rates
       were at least 10 Hz and the height levels Hlo and Hhi were set
       (in the selected reference OSMod/Task-id) within the allowed
       limits for atmospheric calculations (Hlo between 0 and 30 km
       and Hhi between 70 and 120 km).


 3) ===  BUTTON for selecting Ionosphere Processing  ===

    Purpose:
       Activate the DMI Ionospheric Bending Angle Retrieval Tool, allows
       to choose among No Ionospheric- and DMI Abel Transform Ionos.
       Refractivity Profiles Retrieval, and No Ion.- or Electron Density
       Profiles Retrieval.

    Type:
       Exclusive button.

    Format/Usage:
       Press the button which causes the proper droplist entries for
       Bending Angle Retrieval Specifications, Refractivity- and Iono-
       spheric Profiles Retrieval Specifications to be set.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available for ionosphere processing, if the height levels Hlo
       and Hhi were set (in the selected reference OSMod/Task-id) within
       the allowed limits for ionospheric calculations (Hlo between 0 and
       200 km and Hhi between 500 km and the lowest perigee of the chosen
       LEO-satellite constellation).



INPUT EXAMPLE(S)

- Activate the Atmospheric Inverse Fresnel Transform routine:
   Press the Atm. Inverse Fresnel Transform button (this is only possible
   for atmospheric processing, if the chosen FoMod/OSMod GNSS receiver
   sampling rate was set at least to 10 Hz - cf. Special Notes/Hints).
```

5.8.6 Bending Angle Retrieval Specifications

GENERAL DESCRIPTION

This input allows to select among 4 different Bending Angle Retrieval Tools ("IAP Differential Correction & Ionosphere Correction & Bending Angle Retrieval", "IGAM/UG Ionosphere Correction & Bending Angle Retrieval", "DMI Standard Ionosphere Correction & Bending Angle Retrieval", "DMI Enhanced Ionosphere Correction & Bending Angle Retrieval") for General Atmosphere Processing (in case of Atmosphere Inverse Fresnel Transform, no Bending Angle Retrieval Tool is available). For Ionosphere Processing, only the DMI Ionosphere Bending Angle Retrieval tool can be used.
For IAP Diff. Corr. & Ion. Corr. & Bend. Angle Retrieval, "No Diff. Correction" or "Backpropagation" can be selected as differential correction type (the latter allows to change the Loc. Backprop. Plane manually) and the Stat. Optimization Type can be set to "No Stat. Optimization", "Optimize using m+z BenA Search", or "Optimize using glob. BenA Search".

```
In case of IGAM/UG Iono. Corr. & Bend. Angle Retrieval or DMI Enhanced
Ion. Corr. & Bend. Angle Retrieval, "Phase Correction" or "Bend. Angle
Correction" can be used for the Ionosphere Correction Type and the
Stat. Optimization Type may be "No Stat. Optimization", "Optimize invoking
MSIS90_DMI", or "Optimize invoking CIRA86aQ_UoG".


SPECIAL NOTES/HINTS

- The DMI Standard Ionosphere Correction & Bending Angle Retrieval Tool
  allows no manual Ionosphere Correction Type and Stat. Optimization Type
  selection.


INPUT PARAMETER(S)

 1) === DROPLIST for Bending Angle Retrieval Tool Choice ===

    Purpose:
       Allows the selection among IAP Differential Correction &
       Ionosphere Correction &  Bending Angle Retrieval,
       IGAM/UG Ionosphere Correction & Bending Angle Retrieval,
       DMI Standard Ionosphere Correction & Bending Angle Retrieval or
       DMI Enhanced Ionosphere Correction & Bending Angle Retrieval
       in case of General Atmosphere Processing; for Ionosphere
       Processing, it the selection is fixed and set to DMI Ionospheric
       Bending Angle Retrieval.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       For General Atmosphere Processing one of the following 4 values:
       'IAP Diff. Corr. &  Ion. Corr. &  Bend. Angle Retrieval',
       'IGAM/UG Ion. Corr. & Bend. Angle Retrieval',
       'DMI Standard Ion. Corr. & Bend. Angle Retrieval',
       'DMI Enhanced Ion. Corr. & Bend. Angle Retrieval'.
       For Ionosphere Processing only the following value exists:
       'DMI Ionospheric Bending Angle Retrieval'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if the General Atmosphere- or the
       Ionosphere Processing button is pressed.


 2) === DROPLIST for Difference Correction Type Choice ===

    Purpose:
       Allows the selection among No Difference Correction and
       Difference Correction.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values:
       'No Diff. Correction',
       'Backpropagation'.

    Notes on Values:
```

```
      ---

   Availability/Indirect Effects:
      The droplist is only available, if "IAP Diff. Corr. &  Ion. Corr. &
      Bend. Angle Retrieval" was chosen as the bending angle retrieval
      tool.


3) === INPUT FIELD for selecting a Local Backpropagation Plane ===

   Purpose:
      Allows the manual setting of a Local Backpropagation Plane by
      keyboard input.

   Type:
      Text input field for input of the Local Backpropagation Plane
      position value.

   Format/Usage:
      Choose a value between 0 and 500 km for the position value.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All numbers (with a maximum of one digit after the comma) between
      0 and 500 km.

   Notes on Values:
      The default Loc. Backprop. Plane input field value is set to "default"
      per definition, because at this point no valid default number is
      available (the IAP Diff. Corr. & Ion. Corr. & Bend. Angle Retrieval
      tool cannot compute this value in advance, it will be later calculated
      after pressing the InRet Save & Compute button).

   Availability/Indirect Effects:
      Only available in case of Difference Correction.


4) === DROPLIST for Ionosphere Correction Type Choice ===

   Purpose:
      Allows the selection between Phase Correction and Bend. Angle
      Correction.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following two values:
      'Phase Correction',
      'Bend. Angle Correction'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available, if not "IAP Diff. Corr. &  Ion. Corr.
      &  Bend. Angle Retrieval" was chosen for the bending angle retrieval
      tool. For 'DMI Standard Ion. Corr. & Bend. Angle Retrieval', the
      droplist is insensitive (and fixed to 'Phase Correction').


5) === DROPLIST for Statistical Optimization Type Choice ===

   Purpose:
      Allows the selection among different Statistical Optimization Types.

   Type:
```

```
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       For IGAM/UG Ion. Corr. & Bend. Angle Retrieval, one of the following
       three values:
       'No Stat. Optimization',
       'Optimize invoking MSIS90_DMI',
       'Optimize invoking CIRA86aQ_UoG'.
       For DMI Enhanced Ion. Corr. & Bend. Angle Retrieval, one of the
       following three values:
       'No Stat. Optimization',
       'Optimize using m+z BenA Search',
       'Optimize using glob. BenA Search'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if 'IGAM/UG Ion. Corr. & Bend. Angle
       Retrieval' or 'DMI Enhanced Ion. Corr. & Bend. Angle Retrieval' was
       chosen for the bending angle retrieval tool. For 'DMI Standard Ion.
       Corr. & Bend. Angle Retrieval', the droplist is insensitive (and fixed
       to 'No Stat. Optimization').


INPUT EXAMPLE(S)

- Selecting IGAM/UG Ionosphere Correction & Bending Angle Retrieval:
   Set bend. angle retrieval tool droplist to 'IGAM/UG Ion. Corr. & Bend.
   Angle Retrieval'.

- Selecting 253 km as location of the Local Backpropagation Plane:
   Set Loc. Backprop. Plane input field to '253'.
```

5.8.7 Refractivity Profiles Retrieval Specifications

```
GENERAL DESCRIPTION

This input allows to select among 2 different Refractivity Profiles
Retrieval/Inversion Tools (No Atmospheric Refractivity Profiles Retrieval,
and DMI Abel Transform Atmos. Refractivity Profiles Retrieval) for General
Atmosphere Processing or it is fixed to DMI Inverse Fresnel Refractivity
Profiles Retrieval for Atmosphere Inverse Fresnel Transform. For Ionosphere
Processing, 'No Ionospheric Refractivity Profiles Retrieval' or
'DMI Abel Transform Ionos. Refractivity Profiles Retrieval' can be chosen
as the refractivity profiles retrieval/inversion tool.


SPECIAL NOTES/HINTS

-


INPUT PARAMETER(S)

 1) === DROPLIST for Refractivity Profiles Retrieval/Inversion Tool Choice ===

    Purpose:
       Allows a selection among several different refractivity profiles
       retrieval/inversion tools.

    Type:
       Droplist with different entries available for selection.
```

```
    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       For General Atmosphere Processing, one of the following two values:
       'No Atmospheric Refractivity Profiles Retrieval',
       'DMI Abel Transform Atmos. Refractivity Profiles Retrieval'.
       For Atmosphere Inverse Fresnel Transform, the fixed value is:
       'DMI Inverse Fresnel Refractivity Profiles Retrieval'.
       For Ionosphere Processing, one of the following two values:
       'No Ionospheric Refractivity Profiles Retrieval',
       'DMI Abel Transform Ionos. Refractivity Profiles Retrieval'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.
```

INPUT EXAMPLE(S)

- Selecting DMI Abel transform ionospheric refractivity profiles retrieval:
  Set droplist to 'DMI Abel Transform Ionos. Refractivity Profiles Retrieval'
  (this is only possible for ionosphere processing).

5.8.8 Atmospheric/Ionospheric Profiles Retrieval Specifications

GENERAL DESCRIPTION

This input allows to select among two or three different Atmospheric Profiles Retrieval Tools. In case of a dry Reference OSMod/Task-id Atmosphere, 'No Atmospheric Profiles Retrieval' or 'DMI Dry Air Profiles Retrieval' can be chosen; if a Reference OSMod/Task-id Atmosphere with humidity was selected, the above list will be supplemented by a third item, the 'DMI/IMG Moist Air Profiles Retrieval' tool. For Ionosphere Processing, one of two Ionosphere Profiles Retrieval Tools can be selected (`No Ionosphere Profiles Retrieval', and 'Electron Density Profiles Retrieval'). If a Reference OSMod/Task-id Atmosphere with humidity was selected, one can choose among six different Moist Air Retrieval Types and six Atmosphere Models available.

SPECIAL NOTES/HINTS

- The Moist Air Retrieval Type and Atmospheric Models for prescribed parameters are only available, if DMI/IMG Moist Air Profiles Retrieval was selected for the Atm. Profiles Retrieval Tool.

INPUT PARAMETER(S)

```
 1) === DROPLIST for Atmospheric/Ionospheric Profiles Retrieval Tool Choice ===

    Purpose:
       Allows the selection among 'No Atmospheric Profiles Retrieval',
       'DMI Dry Air Profiles Retrieval', and 'DMI/IMG Moist Air Profiles
       Retrieval' (the last one can only be selected in case of a humid
       Reference OSMod/Task-id Atmosphere). For Ionosphere Processing,
       'No Ionosphere Profiles Retrieval' or 'Electron Density Profiles
       Retrieval' can be chosen.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.
```

```
   Range of Values:
      In case of Atmosphere Processing, one of the following 3 values:
      'No Atm. Profiles Retrieval',
      'DMI Dry Air Prof. Retrieval',
      'DMI/IMG Moist Air Prof. Ret' (the last one can only be selected
      if the Reference OSMod/Task-id Atmosphere was humid).
      In case of Ionosphere Processing, one of the following two values:
      'No Ion. Profiles Retrieval',
      'Elec. Density Prof. Retrieval'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is always available.


2) === DROPLIST for Moist Air Retrieval Type Choice ===

   Purpose:
      Allows selection among six different Moist Air Retrieval
      Types. The last one (T,q,e,p,rho by Opt.Estimation...) needs some
      additional user input; therefore, an extra Pop-up Window will be
      activated.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 6 values:
      'q,e,p,rho w. T prescribed (It)',
      'q,e,p,rho w. T prescribed (In)',
      'q,e,rho with p,T prescribed',
      'T,e,p,rho w. q prescribed (In)',
      'T,e,rho with p,q prescribed'
      'T,q,e,p,rho by Opt.Estimation...'.

    Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available in case the DMI/IMG Moist Air Profile
      Retrieval was selected as Atmospheric Profile Retrieval Tool.


3) === DROPLIST for Atmospheric Model for prescribed parameters Choice ===

   Purpose:
      Allows the selection among FoMod Atmosphere (RefAtm_UoG),
      Bi-Exponential Atmosphere (RefAtm_UoG), HLat 2D Atmosphere
      (CIRA86aQ_UoG), GCM 3D Atmosphere (GCM3DAtm), HiVRes Atmosphere
      (HiVResAtm) and an User-supplied Atmosphere (RefAtm_UoG).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 6 values:
      'FoMod Atmosphere (Atm-Name)',
      'Bi-Exponential Atm. (RefAtm_UoG)',
      'HLat 2D Atmosphere (CIRA86aQ_UoG)',
      'GCM 3D Atmosphere (GCM3DAtm)...',
```

```
       'HiVRes Atmosphere (HiVResAtm)...',
       'User-supplied Atm. (Atm-Name)'.

     Notes on Values:
       The name "Atm-Name" for a FoMod- or User-supplied Atmosphere
       is only a symbolic name here, because the real name of the chosen
       atmosphere depends on the user and therefore is not known in
       advance.

    Availability/Indirect Effects:
       The droplist is only available in case the DMI/IMG Moist Air Profile
       Retrieval was selected as Atmospheric Profile Retrieval Tool.


INPUT EXAMPLE(S)

- Selecting the moist air profiles retrieval tool:
   Set droplist to 'Moist Air Prof. Retrieval '.

- Selecting HLat 2D atmosphere (CIRA86aQ_UoG):
   Set droplist to 'HLat 2D Atmosphere (CIRA86aQ_UoG)'.
```

5.8.9 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.8.10 Save & Compute

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.3, titled "Save & Compute" .

5.8.11 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

5.8.12 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

5.8.13 Save Input

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.4, titled "Save Input" .

5.8.14 Input Summary

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.3.1, titled "Input Summary" .

5.8.15 Delete OSMod-Tasks Input

5.8.15.1 Delete Task-Ids

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.5.1, titled "Delete Task-Ids" .

5.8.16 Optimal Estimation Retrieval Input

5.8.16.1 Optimal Estimation Retrieval Input

```
GENERAL DESCRIPTION

Provide, in addition to the other atmospheric profiles retrieval tools
available under EGOPS, an Optimal Estimation (OE) retrieval tool to
derive atmospheric temperature and humidity profiles from refractivity
profiles in an optimal manner in the sense of statistical estimation
theory.


Optimal Estimation Retrieval INPUT PARAMETERS

EGOPS allows to adjust several "free input parameters" for the OE input
outlined below. All of these parameters can be - within their range of
validity - freely set by the User just as desired for a specific task.
The "Optimal Estimation Retrieval Input" window, is the convenient
interface EGOPS provides to supply of all of these parameters.

- Type of OE data to be processed:
The Observation + Forward Modeling Error Covariance Matrix Specifications
allows to specify the refractivity rms uncertainty (at 0 and 15 km height)
and the vertical correlation length of refractivity errors.

The Background (T,q) Error Covariance Matrix Specifications allows to
specify the temperature rms uncertainty (at 0 and 15 km height), the
vertical correlation length of temperature errors, the humidity rms
uncertainty (at 0 km and 10 km height), and the vertical correlation
length of humidity errors.
```

5.8.16.2 Observation + Forward Modeling Error Covariance Matrix Specs

```
GENERAL DESCRIPTION

This input group allows to specify the Observation and Forward
Modeling Error Covariance Matrix Specifications, the refractivity rms
uncertainty (at 0 and 15 km height) and the vertical correlation length
of refractivity errors.


SPECIAL NOTES/HINTS

- The refractivity rms uncertainty input is given in percent whereas
  the input unity of the vertical correlation length of refractivity
  errors is given in kilometers.


INPUT PARAMETER(S)

 1) === INPUT FIELD for selecting the Refractivity RMS Uncertainty ===

    Purpose:
       Allows to input the Refractivity RMS Uncertainty at 0 km
```

```
      and at 15 km height by keyboard input.

   Type:
      Text input field for input of the Refractivity RMS Uncertainty
      string.

   Format/Usage:
      Put in the Refractivity RMS Uncertainty values or manipulate the
      individual numbers separately.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The allowed minimum and maximum values are displayed in the info
      label on the right side of the text input field. You will get an
      error message if your values are not appropriate.

   Notes on Values:
      The two numbers must be separated by a blank.

   Availability/Indirect Effects:
      Always available.


 2) === INPUT FIELD for the Vertical Correlation Length of Refrac Errors ===

   Purpose:
      Allows to select the Vertical Correlation Length of Refractivity
      Errors by keyboard input.

   Type:
      Text input field for the input of the Vertical Correlation Length
      of Refractivity Errors number.

   Format/Usage:
      Put in the Vertical Correlation Length of Refractivity Errors number.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All numbers between 0 and 10 [km] (one digit after comma is allowed).

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.
```

INPUT EXAMPLE(S)

```
- Set the Refractivity RMS Uncertainty Numbers at 0 km to be 9.5 % and at
  15 km height to 0.3 %:
   Set the values of the Refractivity RMS Uncertainty input field string to
   '9.5 0.3'.
```

5.8.16.3 Background (T,q) Error Covariance Matrix Specs

GENERAL DESCRIPTION

This input group allows to specify the required Background (T,q) Error Covariance Matrix Specifications. The temperature and humidity rms uncertainty and their corresponding correlation lengths are the four necessary input parameters.

SPECIAL NOTES/HINTS

- The unity of the temperature rms uncertainty is given in Kelvin [K] (two values at 0 and 15 km height are intended for input), whereas the humidity rms uncertainty is represented in percent [%] (two input

```
  values are required for 0 and 10 km height). The input unity of the
  vertical correlation lengths of the temperature and humidity errors
  is given in kilometers.

INPUT PARAMETER(S)

 1) === INPUT FIELD for selecting the Temperature RMS Uncertainty ===

    Purpose:
       Allows to input the Temperature RMS Uncertainty at 0 km
       and at 15 km height by keyboard input.

    Type:
       Text input field for input of the Temperature RMS Uncertainty.

    Format/Usage:
       Put in the Temperature RMS Uncertainty values or manipulate the
       individual numbers separately.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The allowed minimum and maximum values are displayed in the info
       label on the right side of the text input field. You will get an
       error message if your values are not appropriate.

    Notes on Values:
       The two numbers must be separated by a blank.

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for the Vertical Correlation Length of Temp Errors ===

    Purpose:
       Allows to select the Vertical Correlation Length of Temperature
       Errors by keyboard input.

    Type:
       Text input field for the input of the Vertical Correlation Length
       of Temperature Errors number.

    Format/Usage:
       Put in the Vertical Correlation Length of Temperature Errors number.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All numbers between 0 and 50 [km] (one digit after comma is allowed).

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for selecting the Humidity RMS Uncertainty ===

    Purpose:
       Allows to input the Humidity RMS Uncertainty at 0 and at 10 km
       height by keyboard input.

    Type:
       Text input field for input of the Humidity RMS Uncertainty.

    Format/Usage:
       Put in the Humidity RMS Uncertainty values or manipulate the
       individual numbers separately.
       Press <CR> to deliver the input to the system.
```

```
    Range of Values:
       The allowed minimum and maximum values are displayed in the info
       label on the right side of the text input field. You will get an
       error message if your values are not appropriate.

    Notes on Values:
       The two numbers must be separated by a blank.

    Availability/Indirect Effects:
       Always available.


 4) === INPUT FIELD for the Vertical Correlation Length of Humi Errors ===

    Purpose:
       Allows to select the Vertical Correlation Length of Humidity
       Errors by keyboard input.

    Type:
       Text input field for the input of the Vertical Correlation Length
       of Humidity Errors number.

    Format/Usage:
       Put in the Vertical Correlation Length of Humidity Errors number.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All numbers between 0 and 50 [km] (one digit after comma is allowed).

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Set the Temperature RMS Uncertainty Numbers at 0 km to be 0.5 K and at
  15 km height to 13 K:
   Set the values of the Temperature RMS Uncertainty input field string to
   '0.5 13'.
```

5.8.16.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.8.17 Batch Job Input

5.8.17.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

5.8.17.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

5.8.17.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

5.8.18 Batch Processing Information

5.8.18.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

5.8.18.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

5.8.18.3 Terminate Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

5.8.18.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

5.8.18.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

5.8.18.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

6 Visualize/Validate Menu

6.1 Visualize Mission Analysis/Planning Statistics

6.1.1 Visualize MAnPl Statistics

GENERAL DESCRIPTION

The "Visualize Mission Analysis/Planning Statistics" window interface is called via the "MAnPl Statistics..." entry of the "Visualize/Validate" menu.

The basic data visualized by the interface are the result data from MAnPl tasks computed under the "Mission Analysis/Planning" entry of the "Task" menu previously. The User selects specific MAnPl result data, out of all MAnPl data available within the current project, by first assigning within the interface the Task-id of a desired MAnPl task.

Having assigned an "Occultation" MAnPl/Task-id, information on the main input parameters of the current task is displayed at the top of the window, including UT range, height level range (for "Reflection" MAnPl/Task-ids the time step is shown instead of the undefined height level ranges in this case), and the geographic area covered. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations possible for the result data of the current task are occultation (reflection) coverage statistics computations and visibility statistics for fiducial and tracking sites. [See, e.g., the "Help on Task - Help on Mission Analysis/Planning" function to learn what fiducial and tracking sites are.] These computations are performed within post-processing pop-up windows of the interface, which are accessed via the "Compute Occ. Statistics..." or "Compute Refl. Statistics..." and "Compute Vis. Statistics..." buttons.

Occultation (reflection) coverage statistics computations yield 1D and 2D statistics data in form of histogram data (discrete event distribution functions over a 1D or 2D domain). Options available for 1D statistics include the number of events taking place in bins of user-specified width over latitude, or longitude, or Local Time, or duration of events, or obliquity of tangent-point trajectories (w.r.t. to a vertical set or rise of the tangent point). Options available for 2D statistics include the number of events taking place in boxes of user-specified size over longitude-latitude maps, or Local Time-latitude maps, or event duration-latitude maps, or event obliquity-latitude maps. It is also possible to calculate statistical measures for occultation (reflection) tasks. Different options for statistical measures are Number of Events per unit area, mean Distances, rms of Distances, mean Time Separation, and rms of Time Separation.

Visibility statistics computations yield, for each of a given set of LEO receivers involved in the current MAnPl task, the number of occultation events for which successful ground- or spacebased single differencing or double-differencing is possible by each of a given sample of fiducial ground sites (and by all sites together) or additional LEO-satellites, and the number of orbits seen for a given time range per orbit by each of a couple of tracking ground stations (and by all stations together).

The post-processing result data are saved in "display files" which are named with the Task-id of the current task and which indicate through their file extension the type of processing (and, for a given type, the version). For instance "MAnPltest1.Lat02" contains, for a current task named "MAnPltest1", the results of the 2nd post-processing run ("02") for 1D histogram data versus latitude ("Lat").

All "display files" computed so far for the current task are basically available to be visualized. For visualizing a specific result, the User needs to first select the type desired (for 2D histogram data also whether these shall be plotted as 2D histograms or 2D contours) and then the version desired (i.e., the actual "display file" among all versions available for the selected type).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, and the axes ranges (and viewing angle in case of 2D histogram plots). However, these plot settings can also be adjusted by the User before plotting. In addition, the User can decide whether to plot the data directly as they appear in the "display files" (as numbers of events), or "equal area-weighted" (in case occ. statistics data include a dependence on latitude), or "as percentages" (in case of visibility statistics data).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode (for statistical measures data the four-panel mode is not foreseen), and "plot", "overplot", and "erase last" or "erase all" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /<Project-id>/PSfiles subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Mission Analysis/Planning Statistics" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some MAnPl tasks, then pop-up this interface and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

6.2 Visualize Mission Analysis/Planning Statistics Input

6.2.1 MAnPl/Task-ids

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.) The MAnPl/Task-id for Visualize Mission Analysis/Planning Statistics is the name and identification of the Mission Analysis/Planning (MAnPl) Task whose results are to be visualized. In fact, all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Mission/Analysis Planning is saved in the /MAnPl subdirectory of the /<Project-id> directory of your current Project.

SPECIAL NOTES/HINTS

```
- Default MAnPl/Task-id is the last used MAnPl/Task-id.

INPUT PARAMETER(S)

 1) === INPUT FIELD for showing a MAnPl/Task-id ===

    Purpose:
       Shows the currently selected MAnPl/Task-id.

    Type:
       Non editable Text input field for showing the Task-id.

    Format/Usage:
       ---

    Range of Values:
       All existing MAnPl/Task-ids.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available. Remember that the Task-id will be the key name
       throughout the entire EGOPS system for identifying your current Task.


 2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing MAnPl/Task-id ===

    Purpose:
       Allows to select an existing Task-id.

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a
       list of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise
       the only existing Task-id - MAnPldefault - is selected by default and
       the button/select-list window is insensitive).


INPUT EXAMPLE(S)

- Selecting the MAnPldefault Task:
   (The input field need not be touched)
   Select the Task-id 'MAnPldefault' by using the button/select-list window.
```

6.2.2 UT Range

```
GENERAL DESCRIPTION

This label shows the starting date/time of the simulations and the simulation
time range. Therefore, the time range added to the start date/time gives the
time of the end of the simulation.
```

SPECIAL NOTES/HINTS

- It is not possible to modify the given UT Range label.

INPUT PARAMETER(S)

1) === LABEL for showing Start Date/Time and simulation Time Range ===

Purpose:
Shows the Simulation Start Date/Time and simulation Time Range.

Type:
Label for showing the Simulation Start Date/Time and simulation Time Range.

Format/Usage:

Range of Values:
The same as for MAnPl/Task-id UT Range.

Notes on Values:

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- No input possible.

6.2.3 Height Levels/Time Step

GENERAL DESCRIPTION

In case an Occultation Task was selected, the Height Levels of the corresponding MAnPl/Task-id will be shown. The first two height levels (up to 4 height levels might be defined) can be shown.
In case a Reflection Task was selected, instead of the height levels the used time steps are shown.

SPECIAL NOTES/HINTS

- It is not possible to modify the given height levels or time steps label.

INPUT PARAMETER(S)

1) === LABEL for showing the first two height levels ===

Purpose:
Show the first two height levels of an occultation task.

Type:
Label for showing the first two Height Levels.

Format/Usage:

Range of Values:
The same as for MAnPl/Task-id Height Levels.

Notes on Values:

```
    Availability/Indirect Effects:
       Only available if an Occultation Task is selected.


 2) === LABEL for showing the Time Steps ===

    Purpose:
       Show the time steps value of a reflection task.

    Type:
       Label for showing the Time Steps.

    Format/Usage:
       ---

    Range of Values:
       The same as for MAnPl/Task-id Time Steps.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if a Reflection Task was selected.
```

INPUT EXAMPLE(S)

- No input possible.

6.2.4 Geographic Area

GENERAL DESCRIPTION

This label shows the geographic area for which occultation (reflection) events were computed within the time range specified in the "UT Range" input group. Only events are accounted for in the MAnPl computations, for which the tangent (reflection) point (precisely speaking, the tangent point of the lowest height level specified in the "Height Levels" input for occultation MAnPl/Task-ids) lies within the latitude-longitude region specified here.

SPECIAL NOTES/HINTS

- It is not possible to modify the Geographic area label.

INPUT PARAMETER(S)

```
 1) === LABEL for showing the Geographic area ===

    Purpose:
       Shows the Geographic area Range.

    Type:
       Label for showing the Geographic area Range.

    Format/Usage:
       ---

    Range of Values:
       The same as for MAnPl/Task-id Geographic area Range.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

- No input possible.

6.2.5 Display Occultation/Reflection Statistics

GENERAL DESCRIPTION

This input group allows to choose between 1D/2D Histogram, 2D Contours, and Statistical Measures for plotting of the resulting Occultation (Reflection) Statistics Computations data files. The first step in this is to prepare the statistics data within the Occultation (Reflection) Statistics Computations window (details see in help on Occultation/ Reflection Statistics Computation) and to compute the occultation (reflection) numbers (No. of Events). The following plots can be selected:
For 1D Histograms, plots of the occultation numbers versus Latitude, Longitude, Universal- or Local Time, Obliquity Angle and Event Duration, or the Number of OccSats versus Universal Time. In case of reflection data, it is also possible to plot the data versus the Reflection Angle.
For 2D Histograms and 2D Contours, the number of events can be plotted versus Longitude and Latitude, Universal- or Local Time and Latitude, Obliquity Angle and Latitude and versus Event Duration and Latitude.
In case of reflection data, it is also possible to plot the data versus Reflection Angle and Latitude.
For Statistical Measures the Number of Events, the mean- and the rms of Distances, the mean- and the rms of Time Separation can be visualized.

SPECIAL NOTES/HINTS

- The Compute Occultation/Reflection Statistics button is always sensitive.
- The exclusive buttons for 1D/2D Histogram, 2D Contours, and Statistical Measures selection and their respective droplist buttons are only sensitive, if the Display Occultation/Reflection Statistics button was pressed before.

INPUT PARAMETER(S)

1) === BUTTON for activating Display Occ./Refl. Statistics choice field ===

Purpose:
Allows to activate the exclusive buttons for 1D/2D Histogram, 2D Contours, or Statistical Measures plot selection and to activate the associated droplist.

Type:
Button to activate the exclusive buttons 1D/2D Histogram, 2D Contours, or Statistical Measures plot selection and to activate the respective droplist.

Format/Usage:
Press the button to activate the exclusive buttons for 1D/2D Histogram, 2D Contours orStatistical Measures plots and to activate the associated droplist.

Range of Values:
On or off.

Notes on Values:

Availability/Indirect Effects:
Always available.

2,3,4,5) === Exclusive BUTTONS for 1D/2D Histogram, 2D Contours, or Statistical Measures Choice ===

```
   Purpose:
      Allows to select the plot mode.

   Type:
      Four exclusive Buttons for selecting amongst 1D/2D Histogram, 2D
      Contours or Statistical Measures plotting.

   Format/Usage:
      Press the selection button to activatate the respective droplist
      and choose the necessary parameters for the second (second and
      third in case of 2D plots) plot axis.

   Range of Values:
      One of them is always on, the others are always off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Only available, if the Display Occultation Statistics button is in
      on (pressed) position.


6) === DROPLIST for 1D Histogram X-Axis Labeling Choice ===

   Purpose:
      For occultation data, it allows to select between No. of Events
      versus Latitude, vs. Longitude, vs. Universal- or Local Time,
      vs. Obliquity Angle, vs. Event Duration, or Number of Occul-
      tating Satellites versus Universal Time.
      For reflection data, it is also possible to select a plot versus
      Reflection Angle.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation data, one of the following 7 values: 'vs. Latitude',
        'vs. Longitude', 'vs. Universal Time', 'vs. Local Time', 'vs.
        Obliquity Angle', 'vs. Event Duration', 'No. OccSats vs. UT'.
      For reflection data, one of the following 5 values: 'vs. Latitude',
        'vs. Longitude', 'vs. Universal Time', 'vs. Local Time', 'vs.
        Reflection Angle'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available if 1D Histogram was selected. If
      EGOPS finds one or more files of the proper file type, these will
      be displayed in the Display Data Files list window which allows to
      select one of them for plotting.


7) === DROPLIST for Statistical Measures Plot Parameter Choice ===

   Purpose:
      For occultation/reflection Statistical Measures data, it allows
      to select among No. of Events, mean- or rms of Distances, mean-
      or rms of Time Separation.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
```

```
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 5 values: 'Number of Events', 'Distances',
        'rms of Distances', 'Time Separation', 'rms of Time Sep.'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available if Stat. Measures was selected. If
      EGOPS finds one or more files of the proper file type, these will
      be displayed in the Display Data Files list window which allows to
      select one of them for plotting.


 8) === DROPLIST for 2D Histogram/Contours XY-Axis Labeling Choice ===

   Purpose:
      For occultation data, it allows to select among No. of Events
      versus Longitude and Latitude, vs. Universal- or Local Time and
      Latitude, vs. Obliquity Angle and Latitude, and versus Event
      Duration and Latitude.
      For reflection data, it is also possible to select a plot versus
      Reflection Angle and Latitude.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation data one of the following 5 values: 'vs. Longitude
        and Latitude', 'vs. Universal Time and Latitude', 'vs. Local Time
        and Latitude', 'vs. Obliquity Angle and Latitude', 'vs. Event
        Duration and Latitude'.
      For reflection data one of the following 4 values: 'vs. Longitude
        and Latitude', 'vs. Universal Time and Latitude', 'vs. Local Time
        and Latitude', 'vs. Reflection Angle and Latitude'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available if 2D Histogram or 2D Contours is
      selected. If EGOPS finds one or more files of the chosen file type,
      these will be displayed in the Display Data Files list window which
      allows to select one of them for plotting.


INPUT EXAMPLE(S)

- Activate display occultation statistics field:
   Press Display Occ. Statistics button.

- Selecting 2D histogram versus obliquity angle and latitude:
   Use an 'occultation' MAnPl/Task-id, press the 2D Histogram button and
   then set the respective droplist to 'vs. Obliquity Angle and Latitude'.
```

6.2.6 Compute Occultation/Reflection Statistics

GENERAL DESCRIPTION

Pressing of the compute occultation (reflection) statistics button opens a pop-up window that allows to select the statistics type, to specify the statistics computation input and to compute the resulting occultation (reflection) file.

```
SPECIAL NOTES/HINTS

- The 'Compute Occultation (Reflection) Statistics' button is always
  available.


INPUT PARAMETER(S)

 1) === BUTTON for opening Compute Occultation/Reflection Statistics
    Pop-up Window ===

    Purpose:
       The window allows to select the statistics type, to specify the
       statistics computation input and to compute the resulting
       occultation (reflection) file.

    Type:
       Button for opening the Compute Occultation (Reflection)
       Statistics Pop-up Window.

    Format/Usage:
       Press the button to open the pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Compute Occultation (Reflection) Statistics' button is always
       available.


INPUT EXAMPLE(S)

- Opening the 'Compute Occultation Statistics' pop-up window:
   Load an 'occultation' MAnPl/Task-id, and then click on the 'Compute
   Occ. Statistics...' button to open the compute occultation statistics
   pop-up window.
```

6.2.7 Display Visibility Statistics

```
GENERAL DESCRIPTION

This input group allows to choose between differencing statistics and
tracking statistics when plotting the resulting visibility statistics
data files. The first step in this process is to prepare the statistics
data within the visibility statistics computations window (for details,
please see the in help entry on Visibility Statistics Computation) and
to compute the numbers (No. of Events seen).
With Differencing Statistics, data for Double Differencing, for
Groundbased- or for Spacebased Single Differencing can be plotted.
With Tracking Statistics, the current EGOPS version only provides for
plotting of Tracking Statistics for Groundbased Tracking Sites.


SPECIAL NOTES/HINTS

- The Compute Visibility Statistics button is only sensitive, if in the
  corresponding MAnPl/Task-id Differencing Visibility Choice data and/or
  Tracking Visibility Choice data were calculated. For 'reflection' Tasks,
  this button is always insensitive.
- The exclusive buttons for Differencing Statistics and for Tracking
  Statistics selection and the corresponding droplist button or label
  is only sensitive, if the Display Visibility Statistics button is
  pressed.
```

```
INPUT PARAMETER(S)

 1) === BUTTON for activating Display Vis. Statistics choice field ===

    Purpose:
       Allows to select either Differencing Statistics or Tracking
       Statistics plotting and to activate the corresponding droplist
       button or label.

    Type:
       Button to select between Differencing Statistics or Tracking
       Statistics plotting and to activate the corresponding droplist
       button or label.

    Format/Usage:
       Press the button to select between Differencing Statistics or
       Tracking Statistics plotting and to activate the corresponding
       droplist button or label.

    Range of Values:
       On or off.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available, if in the chosen MAnPl/Task-id Differencing Visibility
       data and/or Tracking Visibility data were calculated.


 2,3) === Exclusive BUTTONS for Diff. Stat. or Tracking Statistics Choice ===

    Purpose:
       Allows to select the plot mode.

    Type:
       Two exclusive Buttons for selecting between Differencing Statistics or
       Tracking Statistics plotting.

    Format/Usage:
       Press the selected button to activate of the respective droplist
       (or label).

    Range of Values:
       One of them is always on, the other is always off.

    Notes on Values:
       If, e.g., only Tracking Statistics data were calculated in a
       specific MAnPl/Task-id,  then the Differencing Statistics button
       will always be insensitive and vice versa.

    Availability/Indirect Effects:
       Only available, if the Display Visibility Statistics button is
       set to the on (pressed) position.


 4) === DROPLIST for Differencing Mode Choice ===

    Purpose:
       Allows to select between Double Differencing, Groundbased- or
       Spacebased Single Differencing.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.
```

```
    Range of Values:
       One of the following 3 values: 'for Double Differencing', 'for
       Groundb. Sing. Diff.', 'for Spaceb. Sing. Diff.'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if Differencing Statistics was selec-
       ted. If EGOPS finds one or more files of the proper file type, these
       will be displayed in the Display Data Files list window for selecting
       one of them for plotting.


 5) === LABEL for Tracking Statistics Mode Choice ===

    Purpose:
       Shows the selection of Tracking Statistics for Groundbased Tracking
       Sites (in the current EGOPS version, only Tracking Statistics for
       Groundbased Tracking Sites is possible, so no real choice is offered).

    Type:
       None (label).

    Format/Usage:
       ---

    Range of Values:
       Only 'for Groundb. Track. Sites'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The label is only sensitive, if Tracking Statistics was selected.
       If EGOPS finds one or more files of the proper file type, these will
       be displayed in the Display Data Files list window for selecting
       one of them for plotting.
```

INPUT EXAMPLE(S)

- Activate display visibility statistics field:
   Press Display Vis. Statistics button.

- Selecting differencing statistics for double differencing:
   Press Differencing Statistics button and then set the respective droplist
    to 'for Double Differencing'.

6.2.8 Compute Visibility Statistics

GENERAL DESCRIPTION

Pressing of the compute visibility statistics button opens a pop-up window that allows to select the statistics type, to enter the statistics computation input and to compute the resulting visibility statistics data file.

SPECIAL NOTES/HINTS

- The 'Compute Visibility Statistics' button is always available, if the Display Visibility Statistics button is active.

INPUT PARAMETER(S)

 1) === BUTTON for opening Compute Visibility Statistics Pop-up Window ===

```
    Purpose:
       The window allows to select the statistics type, to enter the statis-
       tics computation input and to compute the resulting visibility
       statistics data file.

    Type:
       Button for opening the Compute Visibility Statistics pop-up window.

    Format/Usage:
       Press the button to open the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Compute Visibility Statistics' button is always available.


INPUT EXAMPLE(S)

- Opening the 'Compute Visibility Statistics' pop-up window:
   Click on the 'Compute Vis. Statistics...' button to open the compute
   visibility statistics pop-up window.
```

6.2.9 Display Data Files

```
GENERAL DESCRIPTION

This list widget shows a list of all preselected occultation/reflection
or visibility statistics files for plotting. If no file is preselected
or found, the list widget will be insensitive. To select a file for
plotting, double click on a listed filename with your mouse.


SPECIAL NOTES/HINTS

- Only one file at a time can be selected.


INPUT PARAMETER(S)

 1) === File LIST for plot file selection ===

    Purpose:
       Allows to select a file (from the file list) for plotting.

    Type:
       List for selecting a file for plotting.

    Format/Usage:
       Double click with your mouse on a listed filename to select it.

    Range of Values:
       All listed filenames.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       If no file is preselected or found, the list will be insensitive.


INPUT EXAMPLE(S)

- Choose MAnPltest.Lat01 for plotting:
   Double click with your mouse on the list entry for MAnPltest.Lat01
```

6.2.10 Plot Settings

GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible to specify a plot title, a legend text. For 1D/2D histograms, all axis ranges and the contour range/separation can be changed for 1D/2D contour plots. For displaying statistical measures data, the plot options are fixed to plot data as are and all axis ranges cannot be changed. For differencing statistics, the fiducial site range, the number axis range and the number axis range/all sites values can be altered. For tracking statistics, instead of the fiducial site range the track site range can be adjusted.

SPECIAL NOTES/HINTS

- The plot settings input window is only sensitive, if a file from the display data files list was already selected.

INPUT PARAMETER(S)

1) === INPUT FIELD for showing the Plot Title ===

Purpose:
Allows to change the default plot title setting.

Type:
Editable Text input field for setting the plot title.

Format/Usage:
Make necessary changes to the plot title by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
All alphanumeric strings with a maximum length of 60 characters.

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

2) === BUTTON for opening Legend Text Pop-up Window ===

Purpose:
The pop-up window allows to change the default legend text.

Type:
Button for opening the legend text pop-up window.

Format/Usage:
Press the button for opening the legend text pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

3) === DROPLIST for Plot Options Choice ===

Purpose:
Allows to choose between plot data as are and plot data equal area weighted (for 2D histogram and 2D contours plots and for 1D histogram versus latitude plots; for the other 1D histogram plots and for statistical measures plots, the droplist is fixed to plot data as are). For differencing and tracking statistics, the droplist can be set to plot data as are or to plot data as percentages.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry. The droplist-button always shows the current setting.

Range of Values:
One of the following 2 values: 'Plot Data as are', 'Plot Data Eq. Area Weighted' ('Plot Data as Percentages') in case of 2D histogram and 2D contours plots and for 1D histogram versus latitude plots; for the other 1D histogram plots and for statistical measures plots, the droplist is fixed to plot data as are. 'Plot Data as Percentages' are available for plot data eq. area weighted, if differencing or tracking statistics was chosen.

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

4,5,6,7,8) === INPUT FIELDS for Axis Rang., View Angle & Cont. Ran./Sep. ===

Purpose:
Allows to modify the preselected values of the parameter and number axis ranges (lower and upper boundaries). For the viewing angle input field, the elevation and the azimuth can be adjusted. For 2D contours plots, the contour range/separation input field allows adjustment of the lower and higher boundaries and of the contour line separation.
For 1D histogram plots, only one parameter and one number axis range is adjustable, whereas for 2D histogram plots, two parameter, one number axis range and one viewing angle input field is adjustable. For 2D contour plots, two parameter axis ranges and one contour range/separation is to be set.

Type:
Text input fields for inputs of parameter/number axis range, view angle and contour range/separation values.

Format/Usage:
Set the lower and upper boundaries of the parameter/number axis ranges (lo hi), the elevation and azimuth for the viewing angle (el az), the lower and higher boundaries for the contour line and the contour line separation (lo hi sep) by keyboard input. Press <CR> to deliver the input to the system.

Range of Values:
For the axis ranges, the lower (upper) boundary must satisfy the condition that all events are inside the selected interval.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
The four input fields are available, if the plot setting window is sensitive: For a 1D histogram, one parameter and one number axis range input field is available; for a 2D histogram, two parameter and one number axis range and the viewing angle input field are available; for 2D contours, two parameter axis ranges and the

contour range/separation input field is avilable.
In case of statistical measures plots, no axis adjustments are allowed therefore all four input fields are set insensitive.

9,10,11) === DROPLIST and INPUT FIELDS for Fiducial and Tracking Sites ===

Purpose:
Allows to select among 6, 12 or 18 fiducial sites and to adjust two axis ranges for differencing statistics plots.
For tracking statistics plots, it allows to select among 2, 4 or 6 tracking sites and to adjust two axis ranges .

Type:
Droplist with different entries available for selection.
Two input fields for input of number axis ranges and of number axis ranges/all sites.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting. For the axis ranges input fields, put in the lower and upper boundaries (lo hi) by keyboard input.

Range of Values:
For the droplist, one of the following 3 values: '6 FidSites' ('2 TrkSites'), '12 FidSites' ('4 TrkSites'), '18 FidSites' ('6 TrkSites'). The values without brackets are for differencing statistics, the values inside the brackets are for tracking statistics. For the axis ranges, the lower (upper) boundary must satisfy the condition that all events are inside the selected interval.
Press <CR> to deliver the input to the system.

Notes on Values:
For the input fields, only numbers are allowed.

Availability/Indirect Effects:
The FidRange droplist is only available, if differencing statistics was chosen for displaying visibility statistics; otherwise, in case of tracking statistics, the TrkRange droplist is available. The two input fields for number axis range and number axis range/all sites are the same for differencing and tracking statistics and are always available, if the plot setting window is sensitive.

INPUT EXAMPLE(S)

- Show legend text pop-up window:
  Press legend text button.

- Set plot options droplist to plot data as are:
  Click on 'Plot Data as are'.

6.2.11 Plot Window

GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible to specify the number of plots to be shown in the plot window (the plot window can be split into one, two or four plot areas; for statistical measures plots, only one or two plot areas are available), to overplot another plot over the first one, to erase the last plot or to erase the full plot window and to print the content of the plot window to a PS-file.

SPECIAL NOTES/HINTS

- The plot window droplist and buttons are only sensitive, if a file from the display data files list was already selected.

```
- Overplot and to PS file button are only sensitive, if a plot is already
  displayed in the plot window.
- In case of a 2D-Plot, the plot viewing angle can also be also be changed
  by mouse movement (inside the graphics window, press the left mouse button
  and move the graphics cursor to get the desired view angle adjustment).


INPUT PARAMETER(S)

 1) === DROPLIST for Plot Panels Choice ===

    Purpose:
       Allows to choose among three different plot window settings.
       Default setting is one display panel, but the two and four display
       panel setting is also available.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'One Display Panel', '2 Display
       Panels', and '4 Display Panels'. In case of statistical measures
       plots only the first two options are possible.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available, if a file from the display data files list was
       already selected for plotting.


 2,3) === BUTTONS for Plot and Overplot ===

    Purpose:
       To plot the chosen data file or to overplot a selected data file
       over an existing plot.

    Type:
       Button for plotting (over-plotting) a selected data file.

    Format/Usage:
       Press the button to plot (overplot) the selected data file.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Plot button is available, if a file from the display data files list
       was already selected for plotting. Overplot button is only sensitive,
       if a plot already exists on the plot window (i.e. the plot button must
       have been pressed before). The maximum number of plots is restricted
       to 20 plots for the whole plot window (for a one panel plot that means
       a maximum of 19 over-plots are possible, for a two panel plot,
       18 over-plots arbitrarily split between the two main plots are possible).


 4,5) === BUTTONS for Erase Last and Erase All ===

    Purpose:
       For erasing the last plot of a multi-panel plot window or for completely
       erasing the whole plot window.

    Type:
```

```
      Button to erase the last plot or the whole plot window content.

   Format/Usage:
      Press the 'Erase Last' button to erase the last plot of a multi-panel
      plot window or to erase the whole plot window with the 'Erase All'
      button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Erase Last (All) button is available, if a file from the display data
      files list was already selected for plotting.


 6) === BUTTON for Colors Choice ===

   Purpose:
      For changing the plot colors and fine tuning their characteristics
      (to learn more about color manipulation, please read the help
      entry for the colors pop-up window).

   Type:
      Button to open the plot color selection window and for fine tuning of
      the plot characteristics.

   Format/Usage:
      Press the button to open the colors pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Colors button is only available, if a file from the display data
      files list was already selected for plotting.


 7) === BUTTON for printing Plot Window content to PS file ===

   Purpose:
      The 'To PS File' button opens a pop-up window for printing the
      content of the plot window to a PS-file. The name of the PS file,
      the size of the plot (DIN-A4 or letter format) and the kind of PS plot
      file (standard or encapsulated PS) can be specified.

   Type:
      Button to open pop-up window for PS file output adjustments.

   Format/Usage:
      Press the button to open to PS file pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      To PS file button is only available, if a file from the display data
      files list was already plotted.

INPUT EXAMPLE(S)

- Set display droplist to 4 panels display:
```

```
   Click on '4 Display Panels'.

- Open the to PS file pop-up window:
   Press 'to PS file...' button.
```

6.2.12 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.2.13 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.2.14 Compute Occultation/Reflection Statistics Input

6.2.14.1 Statistics Type

```
GENERAL DESCRIPTION

This input group allows to choose the occultation/reflection statistics
type among 1D/2D Statistics, Sum/Difference Data, Statistical Measures,
Sum- or Difference of Measures Data. These buttons are exclusive buttons ,
which means, only one of them can be selected for calculation at a specific
time. For 1D Occultation Statistics computations, it is possible to plot the
number of events versus Latitude, Longitude, Universal- or Local Time,
Obliquity Angle, Event Duration, or Number of OccSats versus UT (for 1D
Reflection Statistics computations, the last three items are not available,
but the number of events versus Reflection Angle can be selected).
For 2D Occultation Statistics computations, it is possible to plot the number
of events versus Longitude and Latitude, Universal- or Local Time and
Latitude, Obliquity Angle and Latitude, and versus Event Duration and Latitude
(for 2D Reflection Statistics computation, the last two items are not
available, but the number of events versus Reflection Angle and Latitude can
be chosen as additional input). The Sum/Difference Data droplist allows to
select between Sum of Statistics Data and Difference of Occultation/Reflection
Statistics Data. Statistical Measures, Sum- or Difference of Measure Data can
also be computed in both cases (for occultation or for reflection data).


SPECIAL NOTES/HINTS

- The exclusive button group for 1D/2D Statistics, Sum/Difference Data,
  Statistical Measures, Sum of Measure Data and Difference of Measure Data
  selection are always sensitive. The Droplist buttons for the statistics type
  selection corresponding to 1D Statistics, 2D Statistics and Sum/Difference
  Data are only sensitive, if the respective radio button is selected.


INPUT PARAMETER(S)

 1,2,3) === Exclusive BUTTONS for 1D/2D Statistics and Sum/Diff. Data Choice ===

    Purpose:
       Allows to select among the first three possible different occultation/
       reflection statistics types.

    Type:
       Three exclusive Buttons for selecting amongst 1D Statistics,
       2D Statistics or Sum/Diff. Statistics Data Type.
```

```
   Format/Usage:
      Press the selected button for activating the respective droplist
      and choose the necessary parameters for the second (second and third
      in case of 2D plots) plot axis.

   Range of Values:
      On or off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The exclusive buttons are always available.


4) === DROPLIST for 1D Statistics X-Axis Labeling Choice ===

   Purpose:
      Allows the selection amongst No. of Events versus Latitude, vs.
      Longitude, vs. Universal- or Local Time, vs. Obliquity Angle,
      vs. Event Duration, or No. OccSats versus UT (for occultation
      statistics, in case of reflection statistics the last three items
      are superseded with No. of Events versus Reflection Angle as
      an additional choice selectable).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation statistics, one of the following 7 values:
         'vs. Latitude', 'vs. Longitude', 'vs. Universal Time', 'vs.
         Local Time', 'vs. Obliquity Angle', 'vs. Event Duration',
         'No. OccSats vs. UT'.
      For reflection statistics, one of the following 5 values:
         'vs. Latitude', 'vs. Longitude', 'vs. Universal Time', 'vs.
         Local Time', 'vs. Reflection Angle'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available if 1D Statistics was selected.


5) === DROPLIST for 2D Statistics XY-Axis Labeling Choice ===

   Purpose:
      Allows the selection among No. of Events versus Longitude and
      Latitude, vs. Universal- or Local Time and Latitude, vs. Obliquity
      Angle and Latitude, and versus Event Duration and Latitude (for
      occultation statistics, in case of reflection statistics the last
      three items are superseded, but with No. of Events versus Reflection
      Angle and Latitude as an additional choice).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation statistics, one of the following 5 values:
         'vs. Longitude and Latitude', 'vs. Universal Time and Latitude',
         'vs. Local Time and Latitude', 'vs. Obliquity Angle and Latitude',
         'vs. Event Duration and Latitude'.
      For reflection statistics, one of the following 4 values:
```

```
        'vs. Longitude and Latitude', 'vs. Universal Time and Latitude',
        'vs. Local Time and Latitude', 'vs. Reflection Angle and Latitude'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if 2D Statistics was selected.


 6) === DROPLIST for Sum/Difference Statistics Data Choice ===

    Purpose:
       Allows the selection between sum of statistics data or difference
       of statistics data for occultation/reflection statistics data.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Sum of Stat. Data', 'Difference of
       Stat. Data'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if Sum/Diff. Data was selected.


 7,8,9) === Exclusive BUTTONS for Statistical Measures and Sum- or Diff.
        of Measure Data Choice ===

    Purpose:
       Allows to select amongst three further different
       occultation/reflection statistics types.

    Type:
       Three exclusive Buttons for selecting amongst Statistical
       Measures, Sum of Measure Data, or Difference of Measure Data Type.

    Format/Usage:
       Press the selected button for activation.

    Range of Values:
       On or off.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The exclusive buttons are always available.


INPUT EXAMPLE(S)

- Selecting 2D statistics versus obliquity angle and latitude:
   Press 2D Statistics button and then set the respective droplist to
   'vs. Obliquity Angle and Latitude'.

- Selecting sum of measure data:
   Press the 'Sum of Measure Data' button.
```

6.2.14.2 Statistics Computation Input

GENERAL DESCRIPTION

This input group allows to select UT Range, <Parameter> Ranges and Binsizes, Height Range (if necessary), Occultation/Reflection Event and GNSS Type as the occultation/reflection statistics computation input (for Statistical Measures computation only UT Range, Occultation/Reflection Event and GNSS Type inputs are necessary). The Occultation/Reflection Event Type selection is only possible, if rising and setting events are found, and GNSS Type selection is only possible, if the corresponding Mission Analyses/Planning/Task-id used the GPS and GLONASS system for geometry simulation.

SPECIAL NOTES/HINTS

- The sensitivity of the input fields and drop-lists depends on the current occultation/reflection statistics type settings (1D Statistics versus <Parameter1>, for Statistical Measures, or for 2D Statistics versus <Parameter1> and <Parameter2>) if rising and(or) setting events in the corresponding Mission Analyses/Planning/Task-id are found and if the chosen MAnPl/Task-id used the GPS and(or) GLONASS system for geometry simulation.
- For Sum/Difference Data selection, a separate input window will be mapped instead of the statistics computation input window (for more details on this topic, see help on Sum/Diff. Data Comp. Input).
- The range defaults of all shown statistics computation input values are their maximum ranges.

INPUT PARAMETER(S)

1) === INPUT FIELD for UT Range Choice ===

Purpose:
Allows to change the shown UT range string by keyboard input.

Type:
Text input field for input of the UT Range Date/Time string.

Format/Usage:
Make necessary changes of the UT Range Date/Time string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
The year may be 90,...,99,00,01,...,89 (that means from 1990 till 2089), months from 01 (January) till 12 (December), and for the days the range depends on the chosen month (i.e. February 01 - 28 or 29, if it's a leap-year, October 01 - 31, and so on). Value ranges for hours are from 00 to 23, for minutes and seconds they are from 00 to 59.

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
Always available.

2,3) === INPUT FIELDS for <Parameter> Ranges & Binsizes Choice ===

Purpose:
Allows to change the shown <parameter> range & binsize string by keyboard input. For 1D statistics computation only, one <parameter> range & binsize input field is necessary; for 2D statistics computation, both <parameter> ranges & Binsizes input are needed and therefore sensitive. For 1D statistics, the following <parameters> can be used: Lat- (latitude), Lon- (longitude), UTi- (universal time), LTi- (local time), Chi- (obliquity/reflection angle), Dur- (event duration), LEO- (No. OccSats) Range and Binsize.
For 2D statistics, the first <parameter> can be selected among Lon- (longitude), UTi- (universal time), LTi- (local time), Chi-

(obliquity/reflection angle), and Dur- (event duration) Range and Binsize (the second <parameter> is always fixed to Lat- (latitude) Range and Binsize).

Type:
Text input field for input of the <parameter> Range and Binsize string.

Format/Usage:
Make necessary changes of the <parameter> Range and Binsize string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is not fitting to the rest of the string (the step size, min and max values must properly fit together) will be automatically adjusted (a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
The upper <parameter> Range & Binsize input field is always available.
The lower only in case of 2D statistics computation.

4) === INPUT FIELD for Height Range Choice ===

Purpose:
Allows to change the shown height range string by keyboard input.

Type:
Text input field for input of the height range string.

Format/Usage:
Make necessary changes of the height range string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
The height range values must be compatible with the shown numbers of the used height level string.

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
The height range input field is only available if 1D (2D) statistics will be computed versus obliquity angle (vs. obliquity angle and lat.) or versus event duration (vs. event duration and lat.).

5) === DROPLIST for Occultation Event Type Choice ===

Purpose:
Allows to choose among all occultation events, setting- and rising events.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following 3 values: 'All Occ. Events', 'Setting Events', 'Rising Events'.

Notes on Values:

```
    Availability/Indirect Effects:
       Droplist is only active in case that rising and setting events are
       found. If only rising (setting) events are found, the droplist will
       be fixed to 'Rising Events' ('Setting Events').


 6) === DROPLIST for GNSS Type Choice ===

    Purpose:
       Allows to choose amongst GPS + GLON, GPS and GLON satellite system
       type.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'GPS + GLON', 'GPS', 'GLON'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Droplist is only active in case where GPS + GLON were used in the
       corresponding MAnPl/Task-id geometry simulation. If only the GPS
       (GLONASS) satellite system was used the droplist will be fixed to
       'GPS' ('GLON').


INPUT EXAMPLE(S)

- Select one new height range:
   Select lower level = 2.0 km, upper level = 50.0 km.
   Thus, set input field to '2.0 50.0'.

- Set GNSS type droplist to GLON:
   Click on 'GLON'.
```

6.2.14.3 Sum/Difference Data Computation Input

GENERAL DESCRIPTION

This input group allows to select the Sum/Difference Statistics Type. In the 1D occultation case, among Number of Events vs. Latitude, vs. Longitude, vs. Universal- or Local Time, vs. Obliquity Angle, vs. Event Duration, and No. OccSats vs. UT can be chosen (for 1D reflection the first 4 inputs are the same and as fifth possibility vs. Reflection Angle was added). For 2D occultations, among No. of Events vs. Longitude and Latitude, vs. Universal- or Local Time and Lat., vs. Obliquity Angle and Lat., or versus Event Duration and Latitude can be selected (for 2D reflection the first three values are the same and additionally No. of Events vs. Reflection Angle and Latitude can be chosen). Sum- or Difference of Measure Data can be made from Number of Events, mean- or rms of Distances, and mean- or rms of Time Separation. The primary and reference data files can be selected from a respective pick-file window (in case of primary data file) or from the respective file select list (in case of reference data file). For Sum, the file content of the primary and reference data files will be added together, for Difference the file content of the reference data file will be subtracted from the file content of the primary data file.

SPECIAL NOTES/HINTS

- The file path and file name filter are automatically set to the proper parameters and can not manually changed by keyboard input.

```
INPUT PARAMETER(S)

 1) === DROPLIST for 1D/2D Sum/Difference Statistics Type Choice ===

    Purpose:
       Allows to choose among Sum/Diff Statistics Type vs. Latitude,
       vs. Longitude, vs. Universal- or Local Time, vs. Obliquity Angle,
       vs. Event Duration, No. OccSats vs. UT, vs. Reflection Angle, vs.
       Longitude and Lat., vs. Universal- or Local Time and Lat., vs.
       Obliquity Angle and Lat., vs. Event Duration and Latitude, or
       versus Reflection Angle and Latitude.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       For Occultation Stat. Computation, one of the following 12 values:
          'vs. Latitude', 'vs. Longitude', 'vs. Universal Time', 'vs.
          Local Time', 'vs. Obliquity Angle', 'vs. Event Duration',
          'No. OccSats vs. UT', 'vs. Longitude and Latitude', 'vs.
          Universal Time and Latitude', 'vs. Local Time and Latitude', 'vs.
          Obliquity Angle and Latitude', 'vs. Event Duration and Latitude'.
       For Reflection Stat. Computation, one of the following 9 values:
          'vs. Latitude', 'vs. Longitude', 'vs. Universal Time', 'vs.
          Local Time', 'vs. Reflection Angle', 'vs. Longitude and Latitude',
          'vs. Universal Time and Latitude', 'vs. Local Time and Latitude',
          'vs. Reflection Angle and Latitude'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if the Sum/Diff. Data button was pressed before.


 2) === DROPLIST for Sum/Difference of Measure Data Type Choice ===

    Purpose:
       Allows to choose among Number of Events, mean- or rms of Distances,
       mean- or rms of Time Separation.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 5 values:
          'Number of Events', 'Distances', 'rms of Distances', 'Time
          Separation', 'rms of Time Sep.'.

    Notes on Values:
       The droplist content is the same for occultation or reflection
       statistics computation.

    Availability/Indirect Effects:
       Only available if the Sum- or Diff. of Measure Data button was
       pressed before.


 3) === BUTTON for opening Primary Data File selection tool ===

    Purpose:
       This Pop-up Window allows the selection of a desired primary data
```

file existing in the /<Projectname>/MAnPl/ subdirectory of EGOPS.

Type:
Button for activating the file selection tool.

Format/Usage:
Press the 'Primary Data File...' button to open the Pop-up Window. Select by mouse-click a Primary Data File out of the available ones in the files list (which is highlighted upon selection). Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available.

4) === INPUT FIELD for showing Primary Data File Choice ===

Purpose:
Shows selected primary data file.

Type:
Text input field for showing primary data file (non editable).

Format/Usage:

Range of Values:
All possible file names shown in the pick-file files list.

Notes on Values:

Availability/Indirect Effects:
Always available.

5) === BUTTON/SELECT-LIST WINDOW for selecting a Reference Data File ===

Purpose:
Allows to select a Reference Data File out of all existing ones.

Type:
Pop-up Window which allows to select by mouse-click a string entry from a list of available entries.

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse-click a Reference Data File out of the available ones in the list (which is highlighted upon selection; note that always a default is already set). Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:
Any Reference Data File available in the list.

Notes on Values:

Availability/Indirect Effects:
Available if primary data file was already selected.

6) === INPUT FIELD for showing Primary Data File Choice ===

```
    Purpose:
       Shows selected reference data file.

    Type:
       Text input field for showing reference data file (non editable).

    Format/Usage:
       ---

    Range of Values:
       All possible file names shown in the select-tool file list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

- Set sum/difference statistics type droplist to versus local time:
  Click on 'vs. Local Time'.

- Activating the primary data file selection tool:
  Press the 'Primary Data File...' button.

6.2.14.4 Compute

GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calculation by employing the corresponding software package (in this case written in IDL). It performs the occultation/reflection statistics computations based on the current input and produces the necessary result file for the subsequent visualization. (To learn more about the file structure behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level Help menu.) The name of the resulting occultation file will be shown in the input field below the compute button. It is not allowed to change the predefined resulting occultation/reflection file name. After starting a computation run, an 'Information Window' pops up with a short hint that EGOPS started statistics computing. When the calculation is finished, the 'Information Window' will be closed.

SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to waste computation time and disk space for results not really exploited. Note that some input combinations (very long simulation time ranges etc.) can result in very long computation times.

INPUT PARAMETER(S)

```
 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the occultation/reflection
       statistics computations based on the current input and produces
       the necessary result file for the subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user) the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Result. Occultation/Reflection Filename ===

    Purpose:
       Shows predefined resulting occultation/reflection filename.

    Type:
       Input field non editable.

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (depending on your
   task, you may have some time for other work now ...)
```

6.2.14.5 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.2.14.6 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.2.15 Compute Visibility Statistics Input

6.2.15.1 Statistics Type

```
GENERAL DESCRIPTION

This input group allows to choose between two visibility statistics types.
The first one is differencing statistics and the second one is tracking
```

statistics. These buttons are exclusive buttons which means only one of them can be selected for a calculation. For differencing statistics computations, it is possible to plot the numbers for double differencing, for groundbased- or spacebased single differencing. Tracking statistics can only be done for groundbased tracking sites.

SPECIAL NOTES/HINTS

- The exclusive buttons for differencing or tracking statistics selection are always sensitive, if data for differencing or tracking statistic were prepared in the chosen MAnPl/Task-id.

INPUT PARAMETER(S)

1,2) === Exclusive BUTTONS for Differencing or Tracking Statistics Choice ===

Purpose:
Allows to select the statistics type.

Type:
Two exclusive Buttons for selecting between differencing or tracking statistics.

Format/Usage:
Press the selected button to activate the respective droplist (in case of differencing statistics) or to select groundbased tracking sites, if tracking statistics was pressed.

Range of Values:
One is always on, the other is always off.

Notes on Values:

Availability/Indirect Effects:
The exclusive buttons are available, if the corresponding statistics data were prepared in the chosen MAnPl/task-id.

3) === DROPLIST for Differencing Choice ===

Purpose:
Allows the selection between double differencing and groundbased- or spacebased single differencing.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry. The droplist-button always shows the current setting.

Range of Values:
One of the following 3 values: 'for Double Differencing', 'for Groundb. Single Diff.' or 'for Spaceb. Single Diff.'.

Notes on Values:
The number of entries is dependent on the data calculated in the corresponding MAnPl/Task-id (e.g., if only data for Double Differencing were prepared, the droplist shows only the entry 'for Double Differencing').

Availability/Indirect Effects:
The droplist is only available, if Differencing Statistics was selected.

4) === LABEL for showing Groundbased Tracking Sites Choice ===

```
    Purpose:
       To indicate that groundbased tracking sites was selected for
       tracking statistics.

    Type:
       Label (no input possible).

    Format/Usage:
       ---

    Range of Values:
       'for Groundb. Tracking Sites'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The label is only active if Tracking Statistics was selected.
```

INPUT EXAMPLE(S)

- Selecting double differencing:
  Press Differencing Statistics button and then set the respective drop-list to 'for Double Differencing' (if possible, cf. also the Notes on Values of item 3)

6.2.15.2 Statistics Computation Input

GENERAL DESCRIPTION

This input group allows to select UT Range, <Parameter> Ranges, Occultation Event and GNSS Type. Occultation Event Type selection is only possible, if rising and setting events are found. GNSS Type selection is only possible, if the corresponding Mission Analyses/Planning/ Task-ID used the GPS and GLONASS system for geometry simulation.

SPECIAL NOTES/HINTS

- The sensitivity of the input fields and drop-lists depends on the current visibility statistics type settings (differencing or tracking statistics), if rising and (or) setting events in the corresponding Mission Analyses/Planning/Task-id are found and if the chosen MAnPl/ Task-id used the GPS and (or) GLONASS system for geometry simulation.
- The range defaults of all shown statistics computation input values are at their maximum ranges.

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for UT Range Choice ===

    Purpose:
       Allows to change the UT range string by keyboard input.

    Type:
       Text input field for input of the UT Range Date/Time string.

    Format/Usage:
       Make necessary changes of the UT Range Date/Time string by
       keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The year may be 90,...,99,00,01,...,89 (that means from 1990 till
       2089), months may be from 01 (January) till 12 (December), and for
       the days, the range depends on the chosen month (i.e. February 01-28
       or 29, if it is a leap-year, October 01 - 31, and so on). Value
```

ranges for hours are from 00 to 23 and for minutes and seconds from
00 to 59.

Notes on Values:
Only numbers are allowed (and the dot at the correct position).

Availability/Indirect Effects:
Always available.

2) === INPUT FIELD for Fiducial Site Number Range Choice ===

Purpose:
Allows to change the shown fiducial site no. range string by
keyboard input.

Type:
Text input field for input of the fiducial site no. range string.

Format/Usage:
Make the necessary changes for the fiducial site no. range string
by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is out of range will be automatically adjusted
(a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Only available for differencing statistics.

3) === INPUT FIELD for Fiducial LEOs Number Range Choice ===

Purpose:
Allows to change the fiducial LEOs no. range string by
keyboard input.

Type:
Text input field for input of the fiducial LEOs no. range string.

Format/Usage:
Make the necessary changes for the fiducial LEOs no. range string
by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is out of range will be automatically adjusted
(a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Only available in case of spacebased single differencing statistics
was chosen as differencing statistics type.

4) === INPUT FIELD for Tracking Site Number Range Choice ===

Purpose:
Allows to change the tracking site no. range string by
keyboard input.

Type:
Text input field for input of the tracking site no. range string.

Format/Usage:

Make the necessary changes for the tracking site no. range string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is out of range will be automatically adjusted (a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Only available for tracking statistics.

5) === INPUT FIELD for LEO visibility/orbit Choice ===

Purpose:
Allows to change the LEO visibility time per orbit choice by keyboard input.

Type:
Text input field for input of the LEO visibility/orbit choice.

Format/Usage:
Make the necessary changes for the LEO visibility/orbit choice by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is out of range will be automatically adjusted (a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Only available for tracking statistics.

6) === INPUT FIELD for LEO Number Range Choice ===

Purpose:
Allows to change the given LEO no. range string by keyboard input.

Type:
Text input field for input of the LEO no. range string.

Format/Usage:
Make the necessary changes for the LEO no. range string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
A value which is out of range will be automatically adjusted (a pop-up window informs the user of this process).

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

7) === DROPLIST for Occultation Event Type Choice ===

Purpose:
Allows to choose among all occultation events, setting events and rising events.

Type:

```
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'All Occ. Events', 'Setting Events',
       'Rising Events'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Droplist is only active in case rising and setting events are
       found. If only rising (setting) events are found, the droplist will
       be fixed to 'Rising Events' ('Setting Events').


 8) === DROPLIST for GNSS Type Choice ===

    Purpose:
       Allows to choose among GPS + GLON, GPS and GLON satellite system
       type.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'GPS + GLON', 'GPS', 'GLON'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Droplist is only active in case GPS + GLON were used in the
       corresponding MAnPl/Task-id geometry simulation. If only the GPS
       (GLONASS) satellite system was used, the droplist will be fixed to
       'GPS' ('GLON').


INPUT EXAMPLE(S)

- Select fiducial site number range to 2 5:
   Enter '2 5' into the fiducial site number range field.

- Set GNSS type droplist to GLON:
   Click on 'GLON'.
```

6.2.15.3 Compute

GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calculation by employing the corresponding software package (in this case written in IDL). It performs the visibility statistics computations based on the current input and produces the necessary result file for the subsequent visualization. (To learn more about the file structure behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level Help menu.) The name of the resulting visibility file will be shown in the input field below the compute button. It is not allowed to change the predefined resulting visibility file name.
After starting a computation, an 'Information Window' pops up with a short hint that EGOPS started statistics computing. When the calculation is finished, the 'Information Window' will be closed.

```
SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can of course result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the visibility
       statistics computations based on the current input and produces
       the necessary result file for the subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user), the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Visibility Stat. Filename ===

    Purpose:
       Shows predefined resulting visibility statistics data filename.

    Type:
       Input field, non editable.

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
    Press the 'Compute' button and let your machine work (dependent on your
    task you may have some time for other work now...)
```

6.2.15.4 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.2.15.5 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.2.16 Colors Input

6.2.16.1 Color Tables

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.1, titled "Color Tables" .

6.2.16.2 Color Options

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.2, titled "Color Options" .

6.2.16.3 Color Function

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.3, titled "Color Functions" .

6.2.16.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.2.17 PS File Output Input

6.2.17.1 PS File Output

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.9.1, titled "PS File Output" .

6.3 Visualize Geographic Maps

6.3.1 Visualize Geographic Maps

GENERAL DESCRIPTION

The "Visualize Geographic Maps" window interface is called via the

"Geographic Maps..." entry of the "Visualize/Validate" menu.

The basic data visualized by the interface are the result data from MAnPl tasks computed under the "Mission Analysis/Planning" entry of the "Task" menu previously. The User selects specific MAnPl result data out of all MAnPl data available within the current project, by first assigning within the interface the Task-id of a desired MAnPl task. Furthermore, even if no project is currently opened, geographic maps of atmospheric/ionosphere variables can be visualized.

Having assigned a MAnPl/Task-id, information on the main input parameters of the current task is displayed at the top of the window including UT range, height level range, and the geographic area covered. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations, possible for the result data of the current task, yield occultation/reflection event distribution data. These data, more specifically also termed "ground projection data", include information on the geometrical shape (approximate ray-path tracks about the tangent-point trajectory for a given height level range for occultation tasks, or iso-range and iso-doppler curves for reflection tasks), the type (set or rise, GPS or GLONASS), the occurrence in time, and the sequential occultation/reflection event number (within the simulated time interval) of each event (within a selected sample of events). The computations are performed within a post-processing pop-up window of the interface, which is accessed via the "Prepare Occ./Refl. Event Data..." button.

The post-processing result data are saved in "display files" which are named with the Task-id of the current task and which indicate through their file extension the type of processing ("GrProjD" for "Ground Projection Data") and the version. For instance, "MAnPltest1.GrProjD02" contains, for a current task named "MAnPltest1", the results of the 2nd post-processing run ("02") for ground projection data ("GrProjD").

In order to prepare geographic maps of parameters of atmospheric/ionospheric models available within EGOPS, 2D latitude-longitude grids of such parameters can be computed (independent of whether a project is open or not). These grids may either slice an atmosphere/ionosphere field at a selected height (possible for temperature, pressure, density, refractivity, water vapor (pressure), specific humidity, electron density, and ionospheric refractivity (at the GPS/L1 frequency)) or contain vertically integrated quantities (possible for Precipitable Water and Total Electron Content).
These computations are performed within a processing pop-up window of the interface, which is accessed via the "Prepare Atm/Ion Model Data..." button.

The maps data are saved in "display files" (under the /referdata/mapsdata subdirectory of EGOPS) which are named with the acronym of the atmosphere/ionosphere model from which they originate plus the acronym of the parameter mapped. With their extension the files indicate their type ("Map") and the version. For instance, "MSIS90_DMI-Temp.Map01" contains, from the 1st computation for the specific model and parameter ("01"), a geographic map of temperature from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed so far are basically available to be visualized (if no project is open, the atmosphere/ionosphere model maps only).
For visualizing a specific result, the User needs to first select the type desired (either event distribution data or atmosphere/ionosphere model data) and then the version desired (i.e., the actual "display file" among all versions available for the selected type).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the map projection, and the map area (and the contour levels in case of atmosphere/ionosphere model data). However, these plot settings can also be adjusted by the User before plotting. In addition, the User can decide whether to plot the data directly as they appear in the "display files" (as ground projection data showing ray-path tracks about the tangent-point trajectories in case of event distribution data or as contoured 2D images in case of atm/ion model data), or "tagged with occ./refl.event number" (in case of event distr. data), or "tagged with event times" (also in case of event distr. data), or "overplotted on event distr. data" (in case of atm/ion model data). Several important tags can be included for improving the plotting quality (Plot Tangent Point with accumulated UT tags, with LT tags, with GNSS-Id tags, with LEO-Id tags or Plot Tangent Point with GNSS+LEO-Id tags).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (basically in the /<Project-id>/PSfiles subdirectory of EGOPS except for atm/ion data maps, for which the file is directed to the /referdata/mapsdata subdirectory) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Geographic Maps" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some MAnPl tasks and maps of atmosphere/ionosphere model parameters, then pop-up this interface and try out the functionality by a "look-and-feel" approach.
  Where necessary, make a sidekick to a specific On-line Help topic.
  Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

6.4 Visualize Geographic Maps Input

6.4.1 MAnPl/Task-ids

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)
The MAnPl/Task-id for Visualize Geographic Maps is the name and identification of the Mission Analysis/Planning (MAnPl) Task whose results are to be visualized. In fact, all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Mission/Analysis Planning is saved in the /MAnPl subdirectory of the /<Project-id> directory of your current Project.
The Visualize Geographic Maps window can also be opened without a specific project. In this case, only maps of atmosphere/ionosphere data are possible. A MAnPl/Task-id cannot be defined at this stage because MAnPl/Task-ids are directly connected with their respective project names (therefore, the MAnPl/Task-id input field is empty and the existing MAnPl/Task-id button is inactive).

SPECIAL NOTES/HINTS

- Default MAnPl/Task-id is the last used MAnPl/Task-id.

```
INPUT PARAMETER(S)

 1) === INPUT FIELD for showing a MAnPl/Task-id ===

    Purpose:
       Shows the currently selected MAnPl/Task-id.

    Type:
       Non editable Text input field for showing the Task-id.

    Format/Usage:
       ---

    Range of Values:
       All existing MAnPl/Task-ids.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available in case of an open project. Remember that the Task-id
       will be the key name throughout the entire EGOPS system for identi-
       fying your current Task.


 2) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing MAnPl/Task-id ===

    Purpose:
       Allows to select an existing Task-id.

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a list
       of available entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if a project is open and more than one Task already
       exists (otherwise the only existing Task-id - MAnPldefault - is
       selected by default and the button/select-list window is insensitive).


INPUT EXAMPLE(S)

- Selecting the MAnPldefault Task:
   Select the Task-id 'MAnPldefault' by using the button/select-list window
   (the input field need not be touched).
```

6.4.2 UT Range

GENERAL DESCRIPTION

This label shows the starting date/time of the simulation and the simulation time range. Therefore, the time range added to the start date/time gives the time of the end of the simulation.

SPECIAL NOTES/HINTS

- It is not possible to modify the given UT Range label.

INPUT PARAMETER(S)

```
 1) === LABEL for showing of Start Date/Time and simulation Time Range ===

    Purpose:
       Shows the Simulation Start Date/Time and simulation Time Range.

    Type:
       Label for showing the Simulation Start Date/Time and simulation
       Time Range string.

    Format/Usage:
       ---

    Range of Values:
       The same as for MAnPl/Task-id UT Range.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if a project was already opened.
```

INPUT EXAMPLE(S)

- Input not possible.

6.4.3 Height Levels/Time Step

GENERAL DESCRIPTION

This label shows the height levels used for the Mission Analysis/Planning simulation, if an occultation task is loaded. The first two height levels (up to 4 height levels might be defined) can be shown. If a reflection task-id is selected, instead of the height levels the used time steps are shown.

SPECIAL NOTES/HINTS

- It is not possible to modify the given height levels/time steps label.

INPUT PARAMETER(S)

```
 1) === LABEL for showing up to the first two height levels or
    for showing the time steps ===

    Purpose:
       Shows up to the first two height levels of an occultation task or
       the used time steps of a reflection task.

    Type:
       Label for showing up to the first two height levels or the time
       steps.

    Format/Usage:
       ---

    Range of Values:
       The same as for MAnPl/Task-id Height Levels (for an occultation task)
       or MAnPl/Task-id Time Steps (for a reflection task).
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if a project was already opened.
```

INPUT EXAMPLE(S)

- Input not possible.

6.4.4 Geographic Area

GENERAL DESCRIPTION

This label shows the geographic area for which occultation (reflection) events were computed within the time range specified in the "UT Range" input group. Only events are accounted for in the MAnPl computations, for which the tangent (reflection) point (precisely speaking, in case of an occultation task, the tangent point of the lowest height level specified in the "Height Levels" input) lies within the latitude-longitude region specified.

SPECIAL NOTES/HINTS

- It is not possible to modify the given Geographic area label.

INPUT PARAMETER(S)

```
 1) === LABEL for showing the Geographic area ===

    Purpose:
       Shows the Geographic area Range.

    Type:
       Label for showing the Geographic area Range.

    Format/Usage:
       ---

    Range of Values:
       The same as for MAnPl/Task-id Geographic area Range.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if a project was already opened.
```

INPUT EXAMPLE(S)

- Input not possible.

6.4.5 Prepare Occultation/Reflection Event Data

GENERAL DESCRIPTION

Pressing of the prepare occultation (reflection) event data button opens a pop-up window that allows to show the event distribution data type, to select the event distribution data preparation input and to compute the resulting occultation rays (or in case of a reflection task reflection iso-range and/or iso-doppler curves) ground projection data file.

```
SPECIAL NOTES/HINTS

- The prepare occultation (reflection) event data button is always available.


INPUT PARAMETER(S)

 1) === BUTTON for opening Prepare Occultation (Reflection) Event Data Pop-
    up Window ===

    Purpose:
       The window allows to select the event distribution data preparation
       input and to compute the resulting occultation rays (iso-range and/or
       iso-doppler curves) ground projection data file.

    Type:
       Button for opening the prepare occultation (reflection) event data
       pop-up window.

    Format/Usage:
       Press the button to open the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The prepare occultation (reflection) event data button is always
       available.


INPUT EXAMPLE(S)

- Opening prepare occultation event data pop-up window:
   Click on the 'Prepare Occ. Event Data ...' button to open the occultation
   event distribution data preparation pop-up window.
```

6.4.6 Prepare Atmosphere/Ionosphere Model Data

```
GENERAL DESCRIPTION

Pressing the 'Prepare Atmosphere/Ionosphere Model Data' button opens
a pop-up window. This pop-up window allows to select among several
atmosphere/ionosphere models, allows to select a model parameter, to
select the atm/ion model data preparation input and to compute the
resulting atm/ion maps data file.


SPECIAL NOTES/HINTS

- The prepare atmosphere/ionosphere model data button is always available.


INPUT PARAMETER(S)

 1) === BUTTON for opening Prepare Atm/Ion Model Data Pop-up Window ===

    Purpose:
       The window allows to select amongst several atmosphere/ionosphere
       models, allows to select a model parameter, to select the atm/ion
       model data preparation input and to compute the resulting atm/ion
       maps data file.

    Type:
       Button for opening the prepare atmosphere/ionosphere model data
       pop-up Window.
```

```
    Format/Usage:
       Press the 'Prepare Atmosphere/Ionosphere Model Data' button to open
       the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Button is always available.


INPUT EXAMPLE(S)

- Opening 'Prepare Atmosphere/Ionosphere Model Data' pop-up window:
   Click on the 'Prepare Atm/Ion Model Data ...' button to open the
   atm/ion model data preparation pop-up window.
```

6.4.7 Display Geographic Maps

```
GENERAL DESCRIPTION

This input group allows to choose between event distribution data and
atmosphere/ionosphere model data. For atmosphere/ionosphere model data,
selection is among several available plot parameters (temperature,
pressure, density, refractivity, water vapor, specific humidity,
precipitable water vapor, electron density, vertical total electron
content, and ionosphere refractivity).


SPECIAL NOTES/HINTS

- The exclusive buttons for Event Distribution Data and for Atmosphere/
  Ionosphere Model Data selection are always sensitive. The respective
  <Parameter> droplist button is only sensitive in case the Atmosphere/
  Ionosphere Model Data button was pressed.


INPUT PARAMETER(S)

 1,2) === Exclusive BUTTONS for Event Distr. or Atm/Ion Model Data Choice ===

    Purpose:
       Allows to select Event Distribution or Model Data plots.

    Type:
       Two exclusive Buttons for selecting between Event Distr. Data or
       Atm/Ion Model Data plotting.

    Format/Usage:
       Press the proper button for selection of the Event Distribution or
       Model Data plotting.

    Range of Values:
       One of them is always on, the other is always off.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available. If EGOPS found one or more files of the chosen file
       type, they will be displayed in the Display Data Files list window
       for selecting one of them for plotting.


 3) === DROPLIST for Atm/Ion Model Data <Parameter> Choice ===
```

```
    Purpose:
       Allows the selection among temperature, pressure, density, refrac-
       tivity, water vapor, specific humidity, precipitable water vapor,
       electron density, vertical total electron content, and ionospheric
       refractivity.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 10 values: 'Temp', 'Pres', 'Dens', 'Refract',
       'Wvap', 'SpHumid', 'PrecipW', 'ElDens', 'vertTEC', 'Ionrefr'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if Atm/Ion Model Data was selected.
       If EGOPS found one or more files of the chosen file type, they will
       be displayed in the Display Data Files list window for selecting
       one of them for plotting.
```

INPUT EXAMPLE(S)

- Selecting atm/ion model data for geographic maps display:
   Press Atm/Ion Model Data button.

6.4.8 Display Data Files

GENERAL DESCRIPTION

This list widget shows a list of all preselected event distribution or atmosphere/ionosphere model data files for plotting. If no file is pre-selected or found, the list widget will be insensitive. A file can be selected for plotting by double clicking on the listed filename with the mouse.

SPECIAL NOTES/HINTS

- Only one file at a time can be selected.

INPUT PARAMETER(S)

```
 1) === File LIST for plot file selection ===

    Purpose:
       The file list allows to select a file for plotting.

    Type:
       List for selecting a file for plotting.

    Format/Usage:
       Double click with the mouse on a listed filename to select it.

    Range of Values:
       All listed filenames.

    Notes on Values:
       ---

    Availability/Indirect Effects:
```

If no file is preselected or found, the list will be insensitive.

INPUT EXAMPLE(S)

- Choose MAnPldefault1.GrProjD01 for plotting:
  Double click with your mouse on MAnPldefault.GrProjD01.

6.4.9 Plot Settings

GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible to modify the plot title, the legend text, choose amongst several plot options, select one of five different map projections and four map area regions, to zoom in and out, and to vary the <parameter> contour range/separation.

SPECIAL NOTES/HINTS

- The plot settings input window is only sensitive, if a file from the display data files list was selected previously.

INPUT PARAMETER(S)

1) === INPUT FIELD for showing the Plot Title ===

Purpose:
Allows to change the default plot title setting.

Type:
Editable Text input field for showing and changing the plot title.

Format/Usage:
Make necessary changes of the plot title by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
All alphanumeric strings with a maximum length of 60 characters.

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

2) === BUTTON for opening Legend Text Pop-up Window ===

Purpose:
The pop-up window allows to change the default legend text.

Type:
Button for opening the legend text pop-up window.

Format/Usage:
Press the button for opening the legend text pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

```
3) === DROPLIST for Plot Options Choice ===

   Purpose:
      Allows to choose amongst plot data as are, plot tangent point
      with occultation number tags (or specular points with reflection
      number tags for reflection tasks) and plot tangent/specular points
      with UT tags in case of event distributed data or to choose between
      plot data as are or overplot data on event distributed data in case
      of atmosphere/ionosphere model data. Also several further options
      are included (especially for occultation event data).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation event distributed data, one of the following 8 values:
         'Plot Data as are', 'Plot Tang.P. with Occ.No. tags', 'Plot Tang.P.
         with UT tags', 'Plot Tang.P. with accum. UT tags', 'Plot Tang.P.
         with LT tags', 'Plot Tang.P. with GNSS-Id tags', 'Plot Tang.P. with
         LEO-Id tags', 'Plot Tang.P. with GNSS+LEO-Id tags'.
      For reflection event distributed data one, of the following five values:
         'Plot Data as are', 'Plot Spec.P. with Refl.No. tags', 'Plot Spec.P.
         with UT tags', 'Iso-Range only', 'Iso-Doppler only'.
      For Atm/Ion Model Data one of the following two values: 'Plot Data as
         are', 'Overpl. Data on Ev.Distr. Data'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


4) === DROPLIST for Map Projection Choice ===

   Purpose:
      Allows to choose amongst Cylindrical Equidistant, Mollweide,
      Orthographic, Equal Area (Lambert), and Azimuthal (Hammer-
      Aithoff) map projection.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following five values: 'Cylindrical Equidistant',
      'Mollweide', 'Orthographic', 'Equal Area (Lambert)', 'Azimuthal
      (Hammer-Aithoff)'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


5) === DROPLIST for Map Area Choice ===

   Purpose:
      Allows to choose amongst Global, Northern Hemisphere, Southern
      Hemisphere, and Regional map area.

   Type:
```

```
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 4 values: 'Global', 'Northern Hem.', 'Southern
      Hem.', 'Regional...'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


6) === BUTTON for Zooming in a specified Plot Area ===

   Purpose:
      This button allows to select a specific plot region for zooming.

   Type:
      Button for activating the graphic cursor in the draw window which
      allows to select a rectangular field for zooming.

   Format/Usage:
      Press the 'Zoom in...' button to activate the graphic cursor in
      the plot window. Draw with the graphic cursor by constant pressing
      the left mouse button a rectangle over an interesting plot area.
      Zoom the chosen area by clicking the 'Plot' button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive, and
      a plot was already displayed in the plot window previously.
      For geographic map projections the zoom function is only
      available with the 'Cylindrical Equidistant' projection.


7) === BUTTON for Restoring the original Plot Size ===

   Purpose:
      This button allows to restore the plot size.

   Type:
      Button for activating the restore function.

   Format/Usage:
      Press the 'Restore' button and then the 'Plot' button to
      restore the zoomed plot image to its original size.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the 'Zoom in...' button was pressed before.


8) === INPUT FIELD for showing/changing Map Area Choice ===

   Purpose:
      Allows to modify the map area in case of regional map area setting.
```

```
      For global, northern or southern hemisphere map area choice,
      the input window is insensitive.

   Type:
      Text input field for input of minimum and maximum latitude and
      minimum and maximum longitude.

   Format/Usage:
      Put in the lower and upper boundaries of the latitude and longitude
      band by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Latitude from -90.0 to 90.0 and Longitude from -180.0 to 180.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      The input field is available, if the plot setting window is sensitive
      and the map area droplist is set to regional.


 9) === INPUT FIELD for <Parameter> Contour Range/Separation Choice ===

   Purpose:
      Allows to modify the <Parameter> Contour Range/Separation in case
      of atmosphere/ionosphere model data. The lower an upper value plus
      the separation (step size) can be specified.

   Type:
      Text input field for input of minimum and maximum contour range
      value and contour step size.

   Format/Usage:
      Put in the lower and upper boundaries of the contour range interval
      and the contour separation by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      Default values are representing the minimum and maximum contour
      range value interval. A maximum of 30 steps are allowed. Smaller
      values for the contour line separation (that means more then 30
      steps) are not allowed and are adjusted to the default values.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      The input field is available, if the plot setting window is
      sensitive and atmosphere/ionosphere model data are chosen.


INPUT EXAMPLE(S)

- Show legend text pop-up window:
   Press legend text button.

- Set plot options droplist to plot data as are:
   Click on 'Plot Data as are'.

- Zoom in an interesting area around an reflection event:
   Click on the 'Zoom in...' button. Move the graphics cursor near to
   the interesting reflection spot and then draw a rectangle over this
   area by constantly pressing the left mouse button while moving the
   mouse to create the zoom frame. To zoom into this region, press the
   'Plot' button afterwards.
```

6.4.10 Plot Window

GENERAL DESCRIPTION

This input group allows to specify several plot settings. The first option is the number of plots to be shown in the plot window (the plot window can be split into one, two or four plot areas). The plot button displays the chosen plot and the overplot button allows to overplot another plot over the previous one. The erase function clears the plot window, whereas the colors button opens a plot colors pop-up window for manipulating and adjusting the plot colors. The 'To PS File' button opens a pop-up window for printing the content of the plot window to a PS-file.

SPECIAL NOTES/HINTS

- The plot window droplist and buttons are only sensitive, if a file from the display data files list was selected previously.
- The 'Overplot' and 'To PS File' buttons are only sensitive, if a plot is already displayed in the plot window.

INPUT PARAMETER(S)

1) === DROPLIST for Plot Panels Choice ===

Purpose:
Allows to choose among three different plot window settings. Default setting is one display panel, but there are also options to select two and four panels per plot.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry. The droplist-button always shows the current setting.

Range of Values:
One of the following 3 values: 'One Display Panel', '2 Display Panels', and '4 Display Panels'.

Notes on Values:

Availability/Indirect Effects:
Always available if a file from the display data files list was already selected for plotting.

2,3) === BUTTONS for Plot and Overplot ===

Purpose:
To plot the chosen data file or to overplot a selected data file over an existing plot.

Type:
Button for plotting (over-plotting) a selected data file.

Format/Usage:
Press the button to plot (overplot) the selected data file.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Plot button is available, if a file from the display data files list

```
      was already selected for plotting. Overplot button is only sensitive,
      if a plot already exists on the plot window (i.e. the plot button must
      have been pressed before). The maximum number of plots is restricted
      to 20 plots for the  whole plot window (for a one panel plot that means
      a maximum of 19 over-plots are possible, for a two panel plot,
      18 over-plots arbitrarily split between the two main plots are possible)


4,5) === BUTTONS for Erase Last and Erase All ===

   Purpose:
      For erasing the last plot of a multi-panel plot window or for completely
      erasing the whole plot window.

   Type:
      Button to erase the last plot or the whole plot window content.

   Format/Usage:
      Press the 'Erase Last' button to erase the last plot of a multi-panel
      plot window or to erase the whole plot window with the 'Erase All'
      button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Erase Last (All) button is available, if a file from the display data
      files list was already selected for plotting.


6) === BUTTON for Colors Choice ===

   Purpose:
      For changing the plot colors and fine tuning their characteristics
      (to learn more about color manipulation, please read the help
      entry for the colors pop-up window).

   Type:
      Button to open the plot color selection window and for fine tuning of
      the plot color characteristics.

   Format/Usage:
      Press the button to open the colors pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Colors button is only available, if a file from the display data
      files list was already plotted.


7) === BUTTON for printing Plot Window content to PS file ===

   Purpose:
      The 'To PS File' button opens a pop-up window for printing the
      content of the plot window to a PS-file for. The name of the PS file,
      the size of the plot (DIN-A4 or letter format) and the kind of PS plot
      file (standard or encapsulated PS) can be specified.

   Type:
      Button to open pop-up window for PS file output adjustments.

   Format/Usage:
      Press the 'To PS File' button to open the pop-up window.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'To PS File' button is only available, if a file from the display
       data files list was already plotted.
```

INPUT EXAMPLE(S)

```
- Set display droplist to 4 panels display:
   Click on '4 Display Panels'.

- Open the to PS file pop-up window:
   Press 'to PS file...' button.
```

6.4.11 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.4.12 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.4.13 Occultation/Reflection Event Distribution Data Preparation Input

6.4.13.1 Event Distribution Data Type

DESCRIPTION

Occultation (Reflection) Rays Ground Projection Data about Tangent (Specular) Points is the single fixed option (so no actual choice is available but the input is designed to be readily expandable for add-on choices). The framed Label "Occultation Rays Ground Projection Data (about Tangent Points)" or, in case of a reflection task, "Reflection Rays Ground Projection Data (about Specular Points)" is displayed to highlight this fixed option.

6.4.13.2 Event Distribution Data Preparation Input

GENERAL DESCRIPTION

This input group allows to select UT Range, Occultation (Reflection) Number Range, Geographic Area, Height Levels (Iso-Range Curves), Along-Ray Distances/Steps (Iso-Doppler Curves), Occultation (Reflection) Event and the GNSS Type (for reflection tasks also the Code Type can be specified). Occultation (Reflection) Event Type selection is only possible, if rising and setting events are found in the corresponding Mission Analyses/Planning/Task-id results. GNSS Type selection is only possible, if the corresponding MAnPl/Task-id used the GPS and GLONASS system for geometry simulation.

SPECIAL NOTES/HINTS

- The sensitivity of the droplists depends on whether rising and(or)

setting events are found in the corresponding Mission Analyses/Planning/ Task-id and if the chosen MAnPl/Task-id used the GPS and(or) GLONASS system for geometry simulation.
- The range defaults of all shown event distribution data preparation input values are representing their maximum ranges.

INPUT PARAMETER(S)

1) === INPUT FIELD for UT Range Choice ===

Purpose:
Allows to change the UT range by keyboard input.

Type:
Text input field for input of the UT Range Date/Time string.

Format/Usage:
Make necessary changes of the UT Range Date/Time string by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
For the year from 90,...,99,00,01,...,89 (that means from 1990 till 2089), months from 01 (January) till 12 (December), and for the days the range depends on the chosen month (i.e. February 01 - 28 or 29, if it's a leap-year, October 01 - 31, and so on). Value ranges for hours are from 00 to 23 and for minutes and seconds are from 00 to 59.

Notes on Values:
Only numbers are allowed (and the dot and comma at their correct positions).

Availability/Indirect Effects:
Always available.

2) === INPUT FIELD for input of the Occultation (Reflection) Number Range ===

Purpose:
Allows to set the Occultation (Reflection) Number Range by keyboard input.

Type:
Text input field for input of the Occultation (Reflection) Number Range string.

Format/Usage:
Put in the 3 Occultation (Reflection) Number Range values for the lower- (Nlo), upper- (Nhi) Occultation (Reflection) Number Range and for the step size (Nstep). All 3 values are integers and should be separated at least by a blank.
Press <CR> to deliver the input to the system.

Range of Values:
Depends on the Occultation (Reflection) Number Range in the corresponding MAnPl/Task-id.sgd(.srd)-file.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

3) === INPUT FIELD for Geographic Area Definition ===

Purpose:
Allows to select an arbitrary Geographic Area by directly specifying the desired latitude-longitude region.

```
   Type:
      Text input field for input of the 4 numerical values of min/max
      latitude (LatMin LatMax) and min/max longitude (LonMin LonMax).

   Format/Usage:
      Supply four numerical values with a maximum of two post-comma digits
      per value. Separate the individual values at least by one blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      The first two values specify the minimum and maximum latitude
      (LatMin LatMax) of the chosen area, constrained by
      -90 <= LatMin, LatMax <= 90 and a minimum latitude difference of
      LatMax-LatMin >= 1 [deg].
      The other two values specify minimum and maximum longitude
      (LonMin LoMax) of the selected area, respectively, constrained by
      -180 <=LoMin, LoMax <= 180 and LoMax-LoMin >= 1 [deg].

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available.


4) === INPUT FIELD for Heigth Levels Definition ===

   Purpose:
      Allows to select as many as 4 independent height level ranges
      by directly specifying the desired height level values.

   Type:
      Text input field for the input of up to 12 numbers for 4 independent
      height level ranges.

   Format/Usage:
      Each value of a height level range may be specified with one
      post-comma digit and all values must be separated by a blank.
      The different height level ranges must be separated by a comma
      and a blank (after the 4th value of a range).
      The first height level value is the lower boundary of the height
      range interval (Hlo), the second is the upper boundary of the
      height range interval (Hhi), and the third denotes the step
      size (Hstep). All units are in [km].
      Press <CR> to deliver the input to the system.

   Range of Values:
      Hlo may be >= 0.0 km (earth surface), Hhi may be up to the
      lowest perigee of the LEO-satellites contained in the current
      leo*.tle file, the minimum step size is 0.1 km and the maximum
      height accuracy dH of the simulation may be 0.05 km.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      For occultation task-ids always available. If two adjacent ranges
      are chosen with different accuracy but common boundary (e.g.,
      Hhi1=Hlo2), then the common boundary computations will be done
      employing the more accurate dH (e.g., MIN(dH1,dH2)) value.


5) === INPUT FIELD for input of Along-Ray Distances/Steps ===

   Purpose:
      Allows to set the Along-Ray Distances/Steps from Tangent Point
      by keyboard input.

   Type:
      Text input field for input of the Along-Ray Distances/Steps string.
```

```
   Format/Usage:
      Each value of Along-Ray Distances/Steps from Tangent Point is an
      integer number and all values need to be separated by a blank.
      The Along-Ray Distances/Steps ranges must be separated by a
      comma and a blank (after the 3rd value of a range).
      The first value is always the lower boundary of the Along-
      Ray Distance range interval (D_Hlox), the second is the upper
      boundary of the Along-Ray Distance range interval (D_Hhix), the
      third denotes the step size (dsx), all values using [km] as its unit.
      Up to 4 Along-Ray Distances/Steps ranges may be specified.
      Press <CR> to deliver the input to the system.

   Range of Values:
      D_Hlo may start at 10 km, D_Hhi may be up to 45000 km high.

   Notes on Values:
      Only numbers are allowed.

   Availability/Indirect Effects:
      Always available for occultation tasks.


6) === BUTTON for activating Iso-Range Curves input field ===

   Purpose:
      Button allows to activate (deactivate) the iso-range curves
      input field.

   Type:
      Button

   Format/Usage:
      Click button for activating the iso-range data input field.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available for reflection tasks. Deactivating of this
      button also deactivates the iso-doppler curve button.


7) === INPUT FIELD for input of the Iso-Range Curves Range ===

   Purpose:
      Allows to set the iso-range curves min/max range and separation by
      keyboard input.

   Type:
      Text input field for input of the Iso-Range Curve minima, maxima,
      and separation number range (all three numbers have to be
      divided by the number of code chips before input).

   Format/Usage:
      Put in the three (CMin CMax CSep) iso-range curves number range
      values for the minimum and maximum curve number (CMin, CMax) and
      for the separation size (CSep) (all of them divided by the Number
      of Code Chips before). All three values should be at least separa-
      ted by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      From 1 to 7.

   Notes on Values:
      Only integer numbers are allowed.
```

```
   Availability/Indirect Effects:
      Only available, if the button for activating the iso-range curves
      input field was pressed previously.


8) === BUTTON for activating Iso-Doppler Curves input field ===

   Purpose:
      Button to activate (deactivate) the iso-doppler curves input field.

   Type:
      Button

   Format/Usage:
      Click button for activating the iso-doppler data input field.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Available for reflection tasks, if the iso-range curves activation
      button was pressed previously.


9) === INPUT FIELD for input of the Iso-Doppler Curves Range ===

   Purpose:
      Allows to set the iso-doppler curves min/max range and separation
      by keyboard input.

   Type:
      Text input field for input of the Iso-Doppler Curve minima, maxima,
      and separation number range string.

   Format/Usage:
      Put in the three (CMin CMax CSep) iso-doppler curves number range
      values for the minimum and maximum curve number (CMin, CMax) and
      for the separation size (CSep). All three values should be at least
      separated by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
      From -999 to 999 [Hz^(-1)].

   Notes on Values:
      Only integer numbers are allowed.

   Availability/Indirect Effects:
      Only available, if the button for activating the iso-doppler curves
      input field was pressed previously.


10) === DROPLIST for Occultation (Reflection) Event Type Choice ===

   Purpose:
      Allows to choose among all occultation (reflection) events,
      setting- or rising events.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For occultation tasks, one of the following three values:
         'All Occ. Events', 'Setting Events', 'Rising Events'.
```

```
      For reflection tasks, one of the following three values:
         'All Refl. Events', 'Setting Events', 'Rising Events'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Droplist is only active in case rising and setting events are found.
      If only rising (setting) events are found the droplist will
      be fixed to 'Rising Events' ('Setting Events').


11) === DROPLIST for GNSS Type Choice ===

   Purpose:
      Allows to choose among GPS + GLON, GPS and GLON satellite system type.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 3 values: 'GPS + GLON', 'GPS', 'GLON'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Droplist is only active in cases for which GPS + GLON was used in
      the corresponding MAnPl/Task-id geometry simulation. If only the GPS
      (GLONASS) satellite system was used, the droplist will be fixed to
      'GPS' ('GLON').


12) === DROPLIST for Code Type Choice ===

   Purpose:
      Allows to choose between C/A or P code type.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'C/A Code', 'P Code'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Droplist is only available for reflection tasks.


INPUT EXAMPLE(S)

- Select new UT range: for 8pm with :
  Select the 3rd May 2000 with 8pm starting and 52 hours 9 minutes and
  20 seconds as the chosen simulation time. Thus set input field to
  '000503.200000,0520920'.

- Set GNSS type droplist to GLON:
  Click on 'GLON'.
```

6.4.13.3 Compute

```
GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical cal-
culation by employing the corresponding software package (in this case
written in IDL). It performs the occultation (reflection) event distri-
bution data computations based on the current input and produces the
necessary result file for the subsequent visualization. (To learn more
about the file structure behind EGOPS, consult the "EGOPS explained..."
Help entry of the main-level Help menu.) The name of the resulting occul-
tation rays ground projection data file will be shown in the input field
below the compute button. It's not allowed to change the predefined resul-
ting occultation (reflection) rays ground projection data file name.
After starting a computation, an 'Information Window' pops up with a short
hint that EGOPS started occultation (reflection) event distribution data
computing. When the calculation is finished, the 'Information Window' will
be closed.


SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the occultation (reflec-
       tion) event distribution data computations based on the current input
       and produces the necessary result file for subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user) the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Occ. (Refl.) Rays Gnd Proj.
    Data File ===

    Purpose:
       Shows the predefined resulting occultation (reflection) rays ground
       projection data filename.

    Type:
       Input field non editable.
```

```
    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
   task you may have some time for other work now...)
```

6.4.13.4 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.4.13.5 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.4.14 Atmosphere/Ionosphere Model Data Preparation Input

6.4.14.1 Atmosphere/Ionosphere Model and Parameter Selection

```
GENERAL DESCRIPTION

This input group allows to choose among several Atmosphere and Ionosphere
Models and among a list of several respective atmospheric (ionospheric)
Parameters. Four different Atmosphere (Bi-Exponential-, HLat 2D-, 3D dry-,
GCM 3D-, and a User-supplied Atmosphere) Models and two Ionosphere (Double-
Chapman- and a 3D Ionosphere) Models are available. The parameters for
Atmosphere Models are temperature, pressure, mass density, refractivity,
water vapor pressure, specific humidity, precipitable water. For Ionosphere
Models, the parameters are electron density, vertical total electron content,
and ionosphere refractivity.


SPECIAL NOTES/HINTS

- The respective Atm. (Ion.) Parameter droplist button is only mapped in
  case an Atmosphere (Ionosphere) model was selected with the Atm/Ion
  Model droplist button.


INPUT PARAMETER(S)

 1) === DROPLIST for Atmosphere/Ionosphere Model Choice ===

    Purpose:
       Allows to select between five different Atmosphere (Bi-Expo-
       nential-, HLat 2D-, 3D dry-, GCM 3D-, and a User-supplied Atmosphere)
       Models and two Ionosphere (Double-Chapman- and a 3D Ionosphere) Models.
```

```
    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 7 values: 'Bi-Exponential Atm. (RefAtm_UoG)',
       'HLat 2D Atmosphere (CIRA86aQ_UoG)', '3D Atmosphere dry (MSIS90_DMI)',
       'GCM 3D Atmosphere (GCM3DAtm)...', 'User-supplied Atm. (RefAtm_UoG)',
       'Double-Chapman Ion. (RefIon_UoG)', '3D Ionosphere (Iono3D_UoG)'.

    Notes on Values:
       Activating the GCM 3D Atmosphere opens an extra pop-up window for
       input of the GRIB data file path and name.

    Availability/Indirect Effects:
       The droplist is always available.


 2) === DROPLIST for Atmosphere/Ionosphere Parameter Choice ===

    Purpose:
       Allows to select between temperature, pressure, mass density,
       refractivity, water vapor pressure, specific humidity, and pre-
       cipitable water in case of Atm. Parameters and between electron
       density, vertical total electron content, and ionosphere
       refractivity in case of Ion. Parameters.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 7 values for Atm. Parameter: 'Temperature (Temp)',
       'Pressure (Pres)', 'Mass Density (Dens)', 'Refractivity (Refract)',
       'Water Vapor Pres. (Wvap)', 'Specific Humidity (SpHumid)', and
       'Precipitable Water (PrecipW)' or one of the following 3 values for
       Ion. Parameter: 'Electron Density (ElDens)', 'Vertical TEC (vertTEC)',
       and 'Ion.Refract.-GPS/L1 (IonRefr)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The Atm. (Ion.) Parameter droplist is only available, if an Atmosphere
       (Ionosphere) Model was selected from the Atm/Ion Model droplist.


INPUT EXAMPLE(S)

- Selecting pressure as atmosphere parameter:
   Select 'Pressure (Pres)' from the Atm.Parameter droplist.
```

6.4.14.2 Atmosphere/Ionosphere Model Data Preparation Input

GENERAL DESCRIPTION

This input group allows to manipulate the Height, Lat- and Lon Grid,
UT, Month and Solar Activity/F107 index.

SPECIAL NOTES/HINTS

```
- Sol.Act./F107 is only sensitive, if an Ionosphere Model was chosen.


INPUT PARAMETER(S)

 1) === INPUT FIELD for Height Choice ===

    Purpose:
       Allows to set the height by keyboard input.

    Type:
       Text input field for input of the height.

    Format/Usage:
       Make necessary changes of the given height by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 0 to 20000 km.

    Notes on Values:
       Only numbers with a maximum of one post comma digit are allowed.

    Availability/Indirect Effects:
       Always available.


 2,3) === INPUT FIELDS for input of the Lat/Lon Grid string ===

    Purpose:
       Allows to set the Latitude/Longitude grid by keyboard input.

    Type:
       Text input fields for input of the Latitude/Longitude grid
       strings.

    Format/Usage:
       Put in the 3 Latitude/Longitude grid values for the lower-
       (Lat/Lon Min), upper- (Lat/Lon Max) Latitude/Longitude grid
       numbers and the value for the Latitude/Longitude grid size
       (dLat/dLon). All 3 values should be at least separated by a
       blank.
       Press <CR> to deliver the input to the system.

    Range of Values:
       For Latitude grid from -90 to 90 deg, for longitude grid
       -180 to 180 deg.

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


 4) === INPUT FIELD for UT specification ===

    Purpose:
       Allows to select the simulation start time.

    Type:
       Text input field for input of the UT.

    Format/Usage:
       Specify the UT in the hour and minute (hhmm) by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 0000 to 2400.

    Notes on Values:
```

```
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


 5) === INPUT FIELD for Month specification ===

    Purpose:
       Allows to select the month.

    Type:
       Text input field for input of the month number.

    Format/Usage:
       Put in the month number (1=Jan,...,12=Dec) by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 1 to 12.

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Always available.


 6) === INPUT FIELD for Solar Activity/F107 index specification ===

    Purpose:
       Allows to select the valid Solar Activity/F107 index.

    Type:
       Text input field for input of the Solar Activity/F107 index number.

    Format/Usage:
       Put in the Solar Activity/F107 index by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 75 to 220.

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Only available in case an Ionosphere Model was chosen.


INPUT EXAMPLE(S)

- Select March as valid month:
   Set the Month input field to '3'.
```

6.4.14.3 Compute

GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calculation by employing the corresponding software package (in this case written in IDL). It performs the atmosphere/ionosphere model data computations based on the current input and produces the necessary result file for the subsequent visualization. (To learn more about the file structure behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level Help menu.) The name of the resulting atmosphere/ionosphere maps data file will be shown in the input field below the compute button. It is not allowed to change the predefined resulting atm/ion maps data file name. After starting a computation an 'Information Window' pops up with a short

```
hint that EGOPS started atm/ion model data computing. When the calculation
is finished, the 'Information Window' will be closed.


SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the atmosphere/ionosphere
       model data computations based on the current input and produces the
       necessary result file for subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user) the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Atm/Ion Maps Data Filename ===

    Purpose:
       Shows the predefined resulting atmosphere/ionosphere maps data
       filename.

    Type:
       Input field (non editable).

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
```

```
task you may have some time for other work now...)
```

6.4.14.4 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

6.4.14.5 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.4.14.6 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

6.4.14.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.4.15 Batch Job Input

6.4.15.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

6.4.15.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.4.15.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

6.4.16 Batch Processing Information

6.4.16.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.4.16.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

6.4.16.3 Terminate Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

6.4.16.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

6.4.16.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

6.4.16.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

6.4.17 Colors Input

6.4.17.1 Color Tables

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.1, titled "Color Tables" .

6.4.17.2 Color Options

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.2, titled "Color Options" .

6.4.17.3 Color Function

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.3, titled "Color Functions" .

6.4.17.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.4.18 PS File Output Input

6.4.18.1 PS File Output

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.9.1, titled "PS File Output" .

6.5 Visualize/Validate Profiles

6.5.1 Visualize Profiles

GENERAL DESCRIPTION

The "Visualize/Validate Profiles" window interface is called via the "Profiles..." entry of the "Visualize/Validate" menu.

The basic data visualized by the "Profiles" interface are the result data of FoMod, or OSMod, or InRet tasks computed before under the "Forward Modeling" entry, or the "Observation System Modeling" entry, or the "Occ. Data Inv./Retrieval" entry of the "Task" menu. The User selects specific FoMod/OSMod/InRet result data, out of all FoMod/OSMod/InRet data available within the current project, by first selecting the generic type of Task (FoMod, or OSMod, or InRet) and then assigning the Task-id of a desired FoMod/OSMod/InRet task.

Having selected a generic type of Task and assigned a corresponding Task-id, information on the occultation event no. range, the generic file names, and the total number of occultation events of the current task is displayed at the top of the window. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations possible for the result data of the current task are absolute and relative difference profiles between profiles of different tasks (of the same generic type) or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events. For visualization of statistics, also standard-deviation-of-mean profiles are automatically included being a function of the computed mean and standard deviation profiles.
These computations are performed within a post-processing pop-up window of the interface, which are accessed via the "Profiles Post-Processing..." button.

For FoMod tasks, the basically available result data for this post-processing comprise "ideal" simulated phase and amplitude data (in terms of "atmospheric (ionospheric) excess phase" and "atmospheric (ionospheric) power loss") as function of occultation event time. The excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases). For visualization, also LI data (ionosphere only at L1) are automatically included being a function of the computed L1, L2, and LC data. The amplitude data are available at the L1 and L2 frequencies.

For OSMod tasks, the basically available data comprise "realistic" simulated phase and amplitude data (in terms of "observed excess phase" and "observed power", "observed" here in the sense of end-to-end simulated observables) as function of occultation event time. The excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (for visualization, also LI data are then derived), the amplitude data at L1 and L2.

For InRet tasks, the basically available data comprise simulated or observed Doppler shift profiles (as function of occ. event time), bending angle profiles (as function of impact parameter), and refractivity, density, pressure, temperature, water vapor, and specific humidity profiles (as function of height). Also, in case of observed data (from the GPS/MET experiment), the original phase and amplitude data are available (as function of occ. event time). The observed excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (for visualization, also LI data are then derived), the amplitude data at L1 and L2.

Furthermore, for InRet tasks, reference "ground-truth" profiles of refractivity, density, pressure, temperature, water vapor (pressure), and specific humidity can be prepared with any available atmospheric model within EGOPS, at the tangent point locations of the retrievals.
These computations are performed within a processing pop-up window of the interface, which is accessed via the "Prepare Atm.Ref. Profiles..." button.
Absolute and relative difference profiles w.r.t. these reference profiles can then be computed, as well as difference profiles statistics (mean difference to "ground-truth" and standard deviations compared to "ground-truth") for samples of events. For visualization of these statistics, also standard-deviation-of-mean profiles are automatically included being a function of the computed mean and standard deviation profiles.
These computations, in turn, are again performed within the "Profiles Post-Processing..." pop-up window noted a few paragraphs above.

The post-processing result data are saved in "display files" which are named with the Task-id of the current task (plus the occultation number if not profile statistics) and which indicate through their file extension the parameter concerned, the type of processing, and, for a given type, the version. For instance "InRettest1_0001.TempDif03" contains, for occultation profile no. 1 ("_0001") of a current task named "InRettest1", the results of the 3rd post-processing run ("03") for a difference profile ("Dif") between temperature profiles ("Temp").
In case of atmospheric reference profile "display files", the original profile's file extension is extended by the acronym of the atmospheric model which serves as "ground-truth" atmosphere. For instance, the file "InRettest1_0001.TempMSIS90_DMI" would contain a temperature reference profile extracted from the dry 3D atmosphere model MSIS90_DMI which is co-located with the profile in "InRettest1_0001.Temp".

All "display files" computed so far for the current task are basically available to be visualized. For visualizing a specific result, the User needs to first select the parameter and the type desired (e.g., difference profiles of temperature) and then the "display file" desired (out of all available ones for the selected parameter and type, which typically may cover a range of occultation numbers and/or versions).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the axes ranges, and the parameter axis type (default linear, another option is logarithmic in case of direct plotting of positive definite result profiles or their atmospheric reference profiles). However, these plot settings can also be adjusted by the User before plotting. After plotting the "zoom in..." button can be used for enlarging interesting details of the plot (the "restore..." button can be used afterwards to restore the original plot image size).

In addition, the User can decide whether to plot the profiles directly as they are obtained from "the display files" (as functions of time, or impact parameter, or height, dependent on the parameter) or whether the data shall be customized in various ways before plotting.
The customization functionality (available always to the extent appropriate for a selected generic type of Task, parameter, and type of plot) includes a function for smoothing the profile data by a user-specified sliding filter width, a function to compute the average value over a selected range of a profile, functions to fit an exponential or a polynomial of user-specified order to a selected range of a profile, a function to select arbitrary profile subsets of the L1, L2, LC, and LI data available (in case of excess phase or Doppler shift data, L1/L2 in case of amplitude data with the ability to visualize, for simulated amplitude observables, absolute or relative power), and a function to select arbitrary profile subsets of the

mean, standard deviation, and standard-deviation-of-mean profiles available (in case of statistics data, with the ability to show absolute or relative standard deviations).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /<Project-id>/PSfiles subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

Additionally, the line style and line thickness can be directly varied by means of two droplist buttons. The annotate function allows to individually create text strings for later annotation of the plot window. Several different text parameters can be altered (i.e. the text alignment, color, direction, position, and the text size). About 16 different character sets are available for creating a text string. These text strings can also be stored for later reuse.

[Detailed help on each function of the "Visualize/Validate Profiles" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some FoMod/OSMod/InRet tasks, then pop-up this interface and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

6.6 Visualize Profiles Input

6.6.1 Task-ids

GENERAL DESCRIPTION

A Task-id (Task identifier) within EGOPS denotes generally the User's name and identification of a specific Task. (Consult the "Help on Task/About Tasks" entry at the menu level in case you need to learn what an EGOPS "Task" is.)
Visualize Profiles can be used with InRet/, OSMod/, and FoMod/Task-ids.
The InRet/Task-id denotes the name and identification of an Occultation Data Inversion Retrieval (InRet) Task, an OSMod/Task-id is the name and identification of an Observation System Modeling (OSMod) Task, whereas FoMod/Task-id stands for a Forward Modeling (FoMod) Task. The default Task-id is the InRet/Task-id.
In fact, all files relating to the current Task will contain the Task-id as leading part of the file name. Specifically, all information relating to Occultation Data Inversion Retrieval (Observation System Modeling, or Forward Modeling) is saved in the /Inret (/OSMod, or /FoMod) subdirectory of the /<Project-id> directory of your current Project.

SPECIAL NOTES/HINTS

- Default InRet/Task-id is the last used InRet/Task-id.

```
INPUT PARAMETER(S)

 1) === DROPLIST to select an InRet/,  OSMod/  or FoMod/Task-id ===

    Purpose:
       Allows to select between an Occultation Data Inversion Retrieval
       (InRet), an Observation System Modeling (OSMod), or a Forward Modeling
       (FoMod) Task.

    Type:
       Pop-up Window which allows to select by mouse-click an entry from a
       list of available entries.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'InRet/Task-id', 'OSMod/Task-id',
       'FoMod/Task-id'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.


 2) === INPUT FIELD for showing the selected Task-id ===

    Purpose:
       Shows the currently selected InRet (OSMod, or FoMod) Task-id.

    Type:
       Non editable Text input field for showing the Task-id.

    Format/Usage:
       ---

    Range of Values:
       All existing InRet (OSMod, or FoMod) /Task-ids.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available. Remember that the Task-id will be the key name
       throughout the entire EGOPS system for identifying your current Task.


 3) ===  BUTTON/SELECT-LIST WINDOW for selecting an existing Task-id ===

    Purpose:
       Allows to select an existing Task-id.

    Type:
       Pop-up Window which allows to select by mouse-click an entry
       from a list of available Task-id entries.

    Format/Usage:
       Press the button which causes a select-list window to pop-up. Select
       by mouse-click a Task-id out of the available ones in the list (which
       is highlighted upon selection; note that always a default is already
       set). Confirm your selection with "Ok" or choose "Cancel" to return
       without action.

    Range of Values:
       Any Task-id available in the list.
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if more than one Task already exists (otherwise
       the only existing Task-id - InRetdefault - is set by default and the
       button/select-list window is insensitive).
```

INPUT EXAMPLE(S)

```
- Selecting the OSModdefault Task:
   Set droplist to 'OSMod/Task-id'.
   Select the Task-id 'OSModdefault' by using the button/select-list window.
```

6.6.2 Profiles Post-Processing

GENERAL DESCRIPTION

Pressing the profiles post-processing button opens a pop-up window that allows to select the processing parameter(s) and type, to specify the single/sample profile processing input and to compute the resulting post-processing data file.

SPECIAL NOTES/HINTS

- The 'Profiles Post-Processing' button is always available.

INPUT PARAMETER(S)

```
 1) === BUTTON for opening Profiles Post-Processing Pop-up Window ===

    Purpose:
       Allows to select the processing parameter(s) and type, to
       specify the single/sample profile processing input and to
       compute the resulting post-processing data file.

    Type:
       Button to open the profiles Post-Processing pop-up window.

    Format/Usage:
       Press the button to open the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Profiles Post-Processing' button is always available.
```

INPUT EXAMPLE(S)

```
- Opening 'Profiles Post-Processing' pop-up window:
   Click on the 'Profiles Post-Processing...' button to open the pop-up
   window.
```

6.6.3 Prepare Atmosphere/Ionosphere Reference Profiles

GENERAL DESCRIPTION

Pressing the prepare atmosphere (ionosphere) reference profiles button opens a pop-up window that allows to select the atmosphere (ionosphere)

```
reference model and parameter and to compute the resulting atmosphere
(ionosphere) reference profiles file(s).


SPECIAL NOTES/HINTS

- The prepare atmosphere reference profiles button is only available, if
  an "atmosphere" InRet/Task-id was selected.
- The prepare ionosphere reference profiles button is only available, if
  an "ionosphere" InRet/Task-id was selected.


INPUT PARAMETER(S)

 1) === BUTTON for opening Prepare Atmosphere/Ionosphere Reference Profiles
    Pop-up Window ===

    Purpose:
       Allows to select the atmosphere (ionosphere) reference model and
       parameter and to compute the resulting atmosphere (ionosphere)
       reference profiles file(s).

    Type:
       Button to open the 'Prepare Atmosphere (Ionosphere) Reference Profiles'
       pop-up window.

    Format/Usage:
       Press the button to open the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Only available if an InRet/Task-id is selected.


INPUT EXAMPLE(S)

- Opening 'Prepare Atmosphere Reference Profiles' pop-up window:
   Choose an atmosphere InRet/Task-id and click on the 'Prepare Atm.Ref.
   Profiles...' button to open the pop-up window.
```

6.6.4 Display Profiles

```
GENERAL DESCRIPTION

This input group allows to choose a parameter to be visualized, to select
single profile info or profile sample info and to set plot modes.


SPECIAL NOTES/HINTS

- The exclusive button for profile sample info selection is only sensitive,
  if the chosen InRet/, OSMod/, and FoMod/Task-id occultation event simu-
  lation type was set to sample of events/realistic geometry.


INPUT PARAMETER(S)

 1) === DROPLIST for Parameter to be Visualized Choice ===

    Purpose:
       Allows to select between doppler shift, bending angle, refractivity,
       density, pressure, temperature, water vapor, and specific humidity
       in case of an atmosphere InRet/Task-id. For an ionosphere
       InRet/Task-id, total electron content, doppler shift, bending angle,
```

```
      refractivity, and electron density may be selected. For
      OSMod/Task-ids, phase or power are selectable, and for FoMod/Task-ids,
      phase or aloss can be selected as parameter to be visualized.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      For atmosphere InRet/Task-ids one, of the following 8 values:
        'Doppler shift', 'Bending Angle', 'Refractivity', 'Density',
        'Pressure', 'Temperature', 'Water Vapor', 'Sp. Humidity'.
      For ionosphere InRet/Task-ids, one of the following 5 values:
        'Total Electron Content', 'Doppler shift', 'Bending Angle',
        'Refractivity', 'Electron Density'.
      For OSMod/Task-ids, one of the following 2 values:
        'Phase', 'Power'.
      For FoMod/Task-ids, one of the following 2 values:
        'Phase', 'ALoss'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is always available.


2,3) === Exclusive BUTTONS for Single Prof.- or Profile Sample Info Choice ===

   Purpose:
      Allows to select between single profile info or profile sample info
      as profiles plotting type.

   Type:
      Two exclusive Buttons for selecting between single profile info or
      profile sample info.

   Format/Usage:
      Press the button to activate of the respective droplist.

   Range of Values:
      One of them is always on, the other is always off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The single profile info choice button is always available. The
      profile sample info choice button is only available, if sample of
      events/realistic geometry was selected in the task-id used.


4) === DROPLIST for Single Profile Plot Mode Choice ===

   Purpose:
      Allows to select between profile(s) directly, difference profile(s),
      and relative difference profile(s).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 3 values: 'Profile(s) Directly', 'Diff.
      Profile(s)', 'Rel. Diff. Profile(s)'.
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if single profile info was selected.
       If EGOPS found one or more files of the chosen file type, these will
       be displayed in the Display Data Files list window for selecting
       one of them for plotting.


 5) === DROPLIST for Profile Sample Plot Mode Choice ===

    Purpose:
       Allows to select between profiles statistics and difference profiles
       statistics.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Profiles Statistics', 'Diff.
       Profiles Statistics'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if an InRet/Task-id without doppler
       shift or bending as parameter to be visualized and profile sample
       info was selected. If EGOPS found one or more files of the chosen
       file type, these will be displayed in the Display Data Files list
       window for selecting one of them for plotting.
```

INPUT EXAMPLE(S)

- Activate density as parameter to be visualized:
  Set the respective droplist to 'Density'.

- Selecting single profile info:
  Press Single Profile Info button.

6.6.5 Display Data Files

GENERAL DESCRIPTION

This list widget shows a list of all preselected Single Profile- or Profile Sample Info files for plotting. If no file is preselected or found, the list widget will be insensitive. To select a file for plotting, double click on a listed filename with your mouse.

SPECIAL NOTES/HINTS

- Only one file at a time can be selected.

INPUT PARAMETER(S)

```
 1) === File LIST for plot file selection ===

    Purpose:
       The file list allows to select a file for plotting.
```

```
    Type:
       List for selecting a file for plotting.

    Format/Usage:
       Double click with your mouse on a listed filename to select it.

    Range of Values:
       All preselected filenames.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       If no file is preselected or found, the list will be insensitive.


INPUT EXAMPLE(S)

- Choose InRetdefault1_0001.Bend for plotting:
   Double click with your mouse on the list entry for 'InRetdefault1_0001.Bend'.
```

6.6.6 Plot Settings

```
GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is
possible to modify the plot title, the legend text, to choose between
two plot options (Plot Data as are or Customize Plot Data), to zoom in
and out, and to select a Linear or Logarithmic Parameter Axis.
For an FoMod/ and OSMod/Task-id, the Time Axis Range and the <Parameter>
(parameter to visualized) Axis Range, and for an InRet/Task-id, the two
respective <Parameter> Axis Ranges can be modified.


SPECIAL NOTES/HINTS

- The plot settings input window is only sensitive, if a file from the
  display data files list was selected.


INPUT PARAMETER(S)

 1) === INPUT FIELD for showing the Plot Title ===

    Purpose:
       Allows to change the default plot title.

    Type:
       Editable Text input field to show and change the plot title.

    Format/Usage:
       Make necessary changes of the plot title by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All alphanumeric strings with a maximum length of 60 characters.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available if the plot setting window is sensitive.


 2) === BUTTON for opening Legend Text Pop-up Window ===

    Purpose:
       The pop-up window allows to change the default legend text.
```

```
   Type:
      Button for opening the legend text pop-up window.

   Format/Usage:
      Press the button to open the legend text pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


3) === DROPLIST for Plot Options Choice ===

   Purpose:
      Allows to choose between plot data as are and customize plot data.
      For customizing plot data, an extra pop-up window will be displayed.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'Plot Data as are', 'Customize Plot
      Data...'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


4) === BUTTON for Zooming in a specified Plot Area ===

   Purpose:
      This button allows to select a specific plot region for zooming.

   Type:
      Button for activating the graphic cursor in the draw window that
      allows to select a rectangular field for zooming.

   Format/Usage:
      Press the 'Zoom in...' button to activate the graphic cursor in
      the plot window. Draw a rectangle with the graphic cursor by
      constantly pressing the left mouse button while moving the mouse
      to create the zoom frame. Zoom the chosen area by clicking the
      'Plot' button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available, if the plot setting window is sensitive and
      a plot was already displayed in the plot window previously.


5) === BUTTON for Restoring the original Plot Size ===

   Purpose:
      This button allows to restore the plot size.
```

Type:
Button for activating the restore function.

Format/Usage:
Press the 'Restore' button and then the 'Plot' button to restore the zoomed plot image to its original size.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available if the 'Zoom in...' button was pressed before.

6,7) === INPUT FIELDS for <Parameter> Axis Range Choice ===

Purpose:
Allows to modify the preselected values for the parameter axis ranges (lower and upper boundaries).

Type:
Text input fields to change the parameter axis ranges.

Format/Usage:
Put in the lower and upper boundaries for the parameter axis ranges (lo hi) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

8) === DROPLIST for Lin/Log Parameter Axis Choice ===

Purpose:
Allows to choose between Linear or Logarithmic Parameter Axis.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following 3 values: 'LinParAx', 'LogPA R+', LogPA R-'.

Notes on Values:
LogPA R+ denotes the logarithmic parameter axis in the positive real number space, LogPA R- is the logarithmic parameter axis for displaying negative real values.

Availability/Indirect Effects:
Always available if the plot setting window is sensitive. The only exception is with FoMod- or OSMod-Tasks, for which the parameter to be visualized was set to ALoss (only possible for FoMod) or to Power (only possible in case of an OSMod task). In this case, the droplist will be fixed to 'LinPar Ax' and set insensitive.

INPUT EXAMPLE(S)

```
- Show legend text pop-up window:
   Press legend text button.

- Set plot options droplist to plot data as are:
   Click on 'Plot Data as are'.

- Zoom in an interesting area around a sharp profile bend:
   Click on the 'Zoom in...' button. Move the graphics cursor near to
   the interesting profile position and then draw a rectangle over this
   area by constantly pressing the left mouse button while moving the
   mouse to create the zoom frame. To zoom into this region, press the
   'Plot' button afterwards.
```

6.6.7 Plot Window

```
GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible
to specify the number of plots to be shown in the plot window (the plot
window can be split in one two or four plot areas), to overplot another
plot over the first one, to erase the last plot or to erase the full
plot window, to print the content of the plot window to a PS-file, to
change Line Style and Line Thickness, to adjust plot colors and to
annotate the plot.

SPECIAL NOTES/HINTS

- The plot window droplist and buttons are only sensitive, if a file from
  the display data files list was already selected.
- Overplot and To PS File button are only sensitive, if a plot is already
  displayed in the plot window.


INPUT PARAMETER(S)

 1) === DROPLIST for Plot Panels Choice ===

    Purpose:
       Allows to choose among three different plot window settings.
       Default setting is one display panel, but the two and four display
       panel setting is also available.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'One Display Panel', '2 Display
       Panels', and '4 Display Panels'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available, if a file from the display data files list was
       selected for plotting.


 2,3) === BUTTONS for Plot and Overplot ===

    Purpose:
       To plot the chosen data file or to overplot a selected data file
       over an existing plot.

    Type:
```

```
      Button for plotting (overplotting) a selected data file.

   Format/Usage:
      Press the button to plot (overplot) the selected data file.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Plot button is available, if a file from the display data files list
      was already selected for plotting. Overplot button is only sensitive,
      if a plot already exists on the plot window (i.e. the plot button must
      have been pressed before). The maximum number of plots is restricted
      to 20 plots for the  whole plot window (for a one panel plot that means
      a maximum of 19 over-plots are possible, for a two panel plot,
      18 over-plots arbitrarily split between the two main plots are possible)


4,5) === BUTTONS for Erase Last and Erase All ===

   Purpose:
      For erasing the last plot of a multi-panel plot window or for completely
      erasing the whole plot window.

   Type:
      Button to erase the last plot or the whole plot window content.

   Format/Usage:
      Press the 'Erase Last' button to erase the last plot of a multi-panel
      plot window or to erase the whole plot window with the 'Erase All'
      button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Erase Last (All) button is available, if a file from the display data
      files list was already selected for plotting.


6) === BUTTON for printing Plot Window content to PS file ===

   Purpose:
      The 'To PS File' button opens a pop-up window for printing the
      content of the plot window to a PS-file for. The name of the PS file,
      the size of the plot (DIN-A4 or letter format) and the kind of PS plot
      file (standard or encapsulated PS) can be specified.

   Type:
      Button to open pop-up window for PS file output adjustments.

   Format/Usage:
      Press the button to open to PS file pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      To PS file button is only available, if a file from the display data
      files list was already plotted.
```

7) === DROPLIST for Line Style Choice ===

Purpose:
Allows to choose among six different line style settings for data plots.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following six values: 'LineStyle= _____', 'LineStyle= .....', 'LineStyle= _ _ _', 'LineStyle= _._._', 'LineStyle= _..._', or 'LineStyle= __ __'.

Notes on Values:

Availability/Indirect Effects:
Always available, if a file from the display data files list was already selected for plotting.

8) === DROPLIST for Line Thickness Choice ===

Purpose:
Allows to choose one of five different line thickness settings.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following five values: 'LineThick= 0.5', 'LineThick= 1.0', 'LineThick= 1.5', 'LineThick= 2.0', 'LineThick= 3.0'.

Notes on Values:

Availability/Indirect Effects:
Always available, if a file from the display data files list was already selected for plotting.

9) === BUTTON for Colors Choice ===

Purpose:
For changing the plot colors and fine tuning their characteristics (to learn more about color manipulation, please read the help entry for the colors pop-up window).

Type:
Button to open the plot color selection window and for fine tuning of the plot color characteristics.

Format/Usage:
Press the button to open the colors pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:

```
       Colors button is only available, if a file from the display data
       files list was already selected for plotting.


 10) === BUTTON for Annotation Choice ===

    Purpose:
       To annotate a plot with explanatory text and notices.
       For learning more about plot annotation, please read the help
       entry of the Annotate... pop-up window).

    Type:
       Button to open the plot annotation window.

    Format/Usage:
       Press the button to open the Annotate... pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The annotate button is only available, if a file from the display
       data files list was already selected for plotting.


 11) === DROPLIST for Annotation On/Off Choice ===

    Purpose:
       Allows to turn the annotation text in the graphics window on or off.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following two values: 'Annot. On', 'Annot. Off'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available, if a file from the display data files list was
       already selected for plotting.


INPUT EXAMPLE(S)

- Set display droplist to 4 panels display:
   Click on '4 Display Panels'.

- Open the to PS file pop-up window:
   Press 'to PS file...' button.
```

6.6.8 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.6.9 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.6.10 Profiles Post_Processing Input

6.6.10.1 Processing for Parameter(s)

```
GENERAL DESCRIPTION

This input group allows to choose between different parameters for profiles
post-processing. The number of possible parameters depends on the modeling
system choice. For InRet/Task-ids, 8 different parameters for atmosphere
profiles post-processing are available (5 for ionosphere profiles
post-processing), whereas for OSMod/- and FoMod/Task-ids, only one parameter
is available for profiles post-processing.


SPECIAL NOTES/HINTS

- In case of OSMod/- and FoMod/Task-ids, the droplist needs not to be touched
  because the (only available) parameter is already set.


INPUT PARAMETER(S)

 1) === DROPLIST for Parameter(s) Choice ===

    Purpose:
       Allows to choose between different parameters for profiles
       post-processing. The number of possible parameters depends on the
       modeling system choice. For InRet/Task-ids, 8 different parameters
       (doppler shift, bending angle, refractivity, density, pressure,
       temperature, water vapor, and specific humidity) for atmosphere pro-
       files post-processing are available, whereas for ionosphere InRet/Task-
       ids, 5 different parameters (total electron content, doppler shift,
       bending angle, refractivity, and electron density) are available for
       ionosphere profiles post-processing. For OSMod/- and FoMod/Task-ids,
       only phase/power and phase/aloss are parameters available for profiles
       post-processing.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       For atmosphere InRet/Task-ids, one of the following 8 values:
         'Doppler shift', 'Bending Angle', 'Refractivity', 'Density',
         'Pressure', 'Temperature', 'Water Vapor', 'Sp. Humidity'.
       For ionosphere InRet/Task-ids, one of the following 5 values:
         'Total Electron Content', 'Doppler shift', 'Bending Angle',
         'Refractivity', 'Electron Density'.
       For OSMod/Task-ids:
         'Phase/Power'.
       For FoMod/Task-ids:
         'Phase/Aloss'.

    Notes on Values:
       ---
```

```
    Availability/Indirect Effects:
       Always available.

INPUT EXAMPLE(S)

- Set droplist to specific humidity:
   Click on 'Sp. Humidity'.
```

6.6.10.2 Processing Type

```
GENERAL DESCRIPTION

This input group allows to select between single profile processing and
profile sample processing and their respective adjustments. The possible
parameters are the same as for InRet/, OSMod/, and FoMod/Task-ids.


SPECIAL NOTES/HINTS

- The exclusive button for profile sample processing selection is only
  sensitive, if the chosen InRet/, OSMod/, and FoMod/Task-id occultation
  event simulation type was set to sample of events/realistic geometry.


INPUT PARAMETER(S)

 1,2) === Exclusive BUTTONS for Single Prof.- or Prof. Sample Proc. Choice ===

    Purpose:
       Allows to select between single profile processing or profile sample
       processing.

    Type:
       Two exclusive Buttons for selecting between single profile or profile
       sample processing.

    Format/Usage:
       Press the selected button for activation of the respective droplist.

    Range of Values:
       One of them is always on, the other is always off.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available. The exclusive button for profile sample proces-
       sing selection is only sensitive, if the chosen InRet/, OSMod/,
       and FoMod/Task-id occultation event simulation type was set to
       sample of events/realistic geometry.


 3) === DROPLIST for Single Profile Mode Choice ===

    Purpose:
       Allows to select between difference profile(s) and relative
       difference profile(s).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Difference Profile(s)', 'Rel. Diff.
```

```
       Profile(s)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if single profile processing was
       selected.


 4) === DROPLIST for Profile Sample Mode Choice ===

    Purpose:
       Allows to selection between profiles statistics and difference
       profiles statistics.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Profiles Statistics', 'Diff.
       Profiles Statistics'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available, if profile sample processing was
       selected.

INPUT EXAMPLE(S)

- Selecting single profile processing:
   Press the 'Single Profile Processing' button.
```

6.6.10.3 Single Profile Processing Input

```
GENERAL DESCRIPTION

This input group allows to select the primary and reference data files.
For difference profiles, the file content of the reference data file will be
subtracted from the file content of the primary data file.
For relative difference profiles, the file content of the reference data file
will be subtracted from the file content of the primary data file and the
result then divided by the content of the reference data file.


SPECIAL NOTES/HINTS

- The file path and file name filter are automatically set to the proper
  parameters and can not be manually changed by keyboard input.


INPUT PARAMETER(S)

1) ===  BUTTON/SELECT-LIST WINDOW for selecting a Primary Data File ===

    Purpose:
       Allows to select a Primary Data File. This select-list allows to
       select a primary data file of in one of the following EGOPS
       subdirectories:
       /EGOPS/<Projectname>/Inret/SimData/<Parameter>/ for InRet/Task-ids,
       /EGOPS/<Projectname>/OSMod/ for OSMod/Task-ids, and
       /EGOPS/<Projectname>/FoMod/ for FoMod/Task-ids.
```

The InRet/SimData/ subdirectories are /Dopp (for Doppler shift), /bend (for Bending Angle), /refr (for Refractivity), /dens (for Density), /pres (for Pressure), /temp (for Temperature), and /wvap (for Water Vapor).

Type:
Button for activating the file selection tool.

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse-click a Primary Data File (which is highlighted upon selection; note that always a default is already set) from the list. Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:
Any Primary Data File available in the list.

Notes on Values:

Availability/Indirect Effects:
Only available, if at least one suitable file was found.

2) === INPUT FIELD for showing Primary Data File Choice ===

Purpose:
Shows selected primary data file.

Type:
Text input field for showing primary data file (non editable).

Format/Usage:

Range of Values:
All possible file names shown in the select-tool files list.

Notes on Values:

Availability/Indirect Effects:
Always available.

3) === BUTTON/SELECT-LIST WINDOW for selecting a Reference Data File ===

Purpose:
Allows to select a Reference Data File. This select-list allows to selection a reference data file from one of the following EGOPS subdirectories:
/EGOPS/<Projectname>/Inret/SimData/<Parameter>/ for InRet/Task-ids,
/EGOPS/<Projectname>/OSMod/ for OSMod/Task-ids, and
/EGOPS/<Projectname>/FoMod/ for FoMod/Task-ids.
The InRet/SimData/ subdirectories are /Dopp (for Doppler shift), /bend (for Bending Angle), /refr (for Refractivity), /dens (for Density), /pres (for Pressure), /temp (for Temperature), and /wvap (for Water Vapor).

Type:
Button for activating the file selection tool.

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse-click a Reference Data File (which is highlighted upon selection; note that always a default is already set) from the list. Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:

```
      Any Reference Data File available in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Only available, if at least one suitable file was found.


 4) === INPUT FIELD for showing Reference Data File Choice ===

   Purpose:
      Shows selected reference data file.

   Type:
      Text input field for showing reference data file (non editable).

   Format/Usage:
      ---

   Range of Values:
      All possible file names shown in the select-tool file list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.

INPUT EXAMPLE(S)

- Activating the primary data file selection tool:
   Press the 'Primary Data File...' button.
```

6.6.10.4 Profile Sample Processing Input

```
GENERAL DESCRIPTION

This input group allows to specify the Occultation Number Range, to choose
an atmosphere reference model and to change the sliding filter width for
smoothed data.


SPECIAL NOTES/HINTS

- The Atmosphere Reference Model button and the respective textfield (right
  of the button) are only sensitive, if at least one atmosphere reference
  model can be found.


INPUT PARAMETER(S)

 1) === INPUT FIELD for input of the Occultation Number Range ===

   Purpose:
      Allows the input of the Occultation Number Range by keyboard input.

   Type:
      Text input field for input of the Occultation Number Range string.

   Format/Usage:
      Put in the 3 Occultation Number Range values for the lower- (lo),
      upper- (hi) Occultation Number Range and for the step size (all
      of them are integers). All 3 values should be at least separated
      by a blank.
      Press <CR> to deliver the input to the system.

   Range of Values:
```

The maximum Occultation Number Range will be always shown in the information label above the Occultation Number Range input field.

Notes on Values:
Only numbers are allowed.

Availability/Indirect Effects:
Always available.

2) === BUTTON/SELECT-LIST WINDOW for selecting an Atmosph. Ref. Model ===

Purpose:
Allows to select an Atmosphere Reference Model out of all existing ones.

Type:
Pop-up Window which allows to select by mouse-click a string entry from a list of available entries.

Format/Usage:
Press the button which causes a select-list window to pop-up. Select by mouse-click an Atmosphere Reference Model out of the available ones in the list (which is highlighted upon selection; note that always a default is already set). Confirm your selection with "Ok" or choose "Cancel" to return without action.

Range of Values:
Any Atmosphere Reference Model available in the list.

Notes on Values:

Availability/Indirect Effects:
Available only, if at least one Atmosphere Reference Model exists (otherwise the button/select-list window is insensitive).

3) === INPUT FIELD for showing the selected Atmosphere Reference Model ===

Purpose:
To show the selected Atmosphere Reference Model.

Type:
Text input field (non editable).

Format/Usage:

Range of Values:
All possible Atmosphere Reference Models from the select list.

Notes on Values:

Availability/Indirect Effects:
Only available, if the Atmosphere Reference Model button is sensitive.

4) === BUTTON/INPUT FIELD for activating/selecting the Sliding Filter Width ===

Purpose:
Button to activate (deactivate) the sliding filter width input field. The sliding filter width input field allows to change the default setting of the filter width.

Type:
Button and text input field for selecting the sliding filter width.

Format/Usage:

```
       Press the Button to activate the sliding filter width input field.
       Then put in the appropriate sliding filter width by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       Only numbers are allowed.

    Availability/Indirect Effects:
       Button for activating (deactivating) the sliding filter width input
       field is always available.


INPUT EXAMPLE(S)

- Selecting a Occultation Number Range:
   Set the lower Occ. No. (lo) to 1 and the upper Occ. No. (hi) to 29
   with a step size of 7.
   Set the input field to '1 29 7'.

- Selecting an Atmosphere Reference Model:
   Press Atmosphere Reference Model button and select the chosen Atmosphere
   Reference Model in the select window by mouse-click. Confirm the selection
   with the ok button (which also closes the select window).
```

6.6.10.5 Compute

```
GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical cal-
culation by employing the corresponding software package (in this case
written in IDL). It performs the profiles post-processing computations
based on the current input and produces the necessary result file for
subsequent visualization. (To learn more about the file structure
behind EGOPS consult the "EGOPS explained..." Help entry of the main-level
Help menu.) The name of the resulting post-processing data file will be
shown in the input field below the compute button. It's not allowed to
change the predefined resulting post-processing data file name.
After starting a computation, an 'Information Window' pops up with a short
hint that EGOPS started profiles post-processing computing. When the cal-
culations are finished, the 'Information Window' will be closed.


SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the profiles post-
       processing computations based on the current input and produces
       the necessary result file for the subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a file needed is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user), the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Post-Processing Data Filename ===

    Purpose:
       Shows the predefined resulting post-processing data filename.

    Type:
       Input field (non editable).

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.

INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
   task you may have some time for other work now...)
```

6.6.10.6 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.6.10.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.6.11 Atmosphere/Ionosphere Reference Profiles Preparation Input

6.6.11.1 Atmosphere/Ionosphere Reference Model Selection

```
GENERAL DESCRIPTION

This input group allows to select among several atmosphere (ionosphere)
models and parameters for calculation of the atmosphere (ionosphere)
```

reference profiles. EGOPS offers 7 different atmosphere models (FoMod-, Bi-Exponential-, HLat 2D Atmosphere, 3D Atmosphere dry, GCM 3D Atmosphere, HiVRes-, and one User-supplied Atmosphere) and 3 different ionosphere models (FoMod-, Double-Chapman, and 3D Ionosphere) for selection.

SPECIAL NOTES/HINTS

- No FoMod atmosphere is available in case of InRet/Tasks, which are using observed data for processing (GPS/MET data).
- The Occultation Number Range to be prepared for cannot be adjusted.

INPUT PARAMETER(S)

1) === DROPLIST for Atmospheric Reference Model Choice ===

Purpose:
Allows a selection among FoMod-, Bi-Exponential-, HLat 2D Atmosphere, 3D Atmosphere dry, GCM 3D Atmosphere, HiVRes Atmosphere and one User supplied Atmosphere for an "atmosphere" InRet/Task-id. For an "ionosphere" InRet/Task-id, a selection among FoMod-, Double-Chapman, and 3D Ionosphere is possible.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry. The droplist-button always shows the current setting.

Range of Values:
For an atmosphere InRet/Task-id, one of the following 6 values:
'FoMod Atmosphere (RefAtm_UoG)','Bi-Exponential Atm. (RefAtm_UoG)', 'HLat 2D Atmosphere (CIRA86aQ_UoG)', '3D Atmosphere dry (MSIS90_DMI)', 'GCM 3D Atmosphere (GCM3Datm)...', 'HiVRes Atmosphere (HiVResAtm)...', 'User-supplied Atm. (RefAtm_UoG)'.
For an ionosphere InRet/Task-id, one of the following 3 values:
'FoMod Ionosphere (RefIon_UoG)','Double Chapman Ion. (RefIon_UoG)', '3D Ionosphere (Iono3D_UoG)'.

Notes on Values:
Selecting the GCM 3D Atmosphere (HiVRes Atmosphere) opens a pop-up window for GRIB (Raob) data file path and file name selection.

Availability/Indirect Effects:
Always available.

2) === BUTTON/SELECT-LIST WINDOW for Refr. Profiles for Parameter Choice ===

Purpose:
Allows to select among several different parameters for calculating the reference profiles. For an atmospheric reference model, the selection is among the four available parameters Refractivity, Density, Pressure, and Temperature (for dry atmospheres) and additionally for Water Vapor and Specific Humidity (for wet atmospheres; humidity is included in the corresponding FoMod-Simulation).
In case of an ionospheric reference model, Refractivity or Electron Density are the two available parameters in the reference profile calculation.

Type:
Button for activating the file selection tool.

Format/Usage:
Pressing the button causes a select-list window to pop-up. Select by mouse-click one parameter out of the available ones in the list (which is highlighted upon selection; note that a default selection is already set). Confirm your selection with "Ok" or choose "Cancel" to return without action.

```
    Range of Values:
       Any of the parameters available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for showing the selected Parameter ===

    Purpose:
       Shows selected parameter for calculation of the reference profile.

    Type:
       Text input field (non editable).

    Format/Usage:
       ---

    Range of Values:
       All possible parameters shown in the select-tool files list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 4) === DROPLIST for Reference Profiles Trajectory Choice ===

    Purpose:
       Allows the selection between two different Profile Trajectories
       (a Vertically Profile at the Mean Tangent Point or a 3D Tangent
       Point Trajectory).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Vertically at Mean TangPoint',
       '3D TangPoint Trajectory'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is always available.


INPUT EXAMPLE(S)

- Activating the reference profiles for parameter selection tool:
   Press the 'Ref. Profiles for Parameter...' button.
```

6.6.11.2 Compute

GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calculation by employing the corresponding software package (in this case written in IDL). It performs the atmosphere reference profiles

```
preparation computations based on the current input and produces the
necessary result file for the subsequent visualization. (To learn more
about the file structure behind EGOPS consult the "EGOPS explained..."
Help entry of the main-level Help menu.) The name of the resulting
atmosphere reference profiles data file will be shown in the input field
below the compute button. It's not allowed to change the predefined
resulting atmosphere reference profiles data file name.
After starting a computation, an 'Information Window' pops up with a short
hint that EGOPS started atmosphere reference profiles computing. When the
calculation is finished, the 'Information Window' will be closed.


SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs the atmosphere
       reference profiles preparation computations based on the current
       input and produces the necessary result file for the subsequent
       visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user), the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Atm./Ion. Reference Profiles Filename ===

    Purpose:
       Shows the predefined resulting atmosphere/ionosphere reference
       profiles data filename.

    Type:
       Input field non editable.

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---
```

```
    Availability/Indirect Effects:
       The input field is always available.

INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
   task you may have some time for other work now...)
```

6.6.11.3 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

6.6.11.4 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.6.11.5 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

6.6.11.6 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.6.12 Batch Job Input

6.6.12.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

6.6.12.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.6.12.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

6.6.13 Batch Processing Information

6.6.13.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.6.13.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

6.6.13.3 Terminate Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

6.6.13.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

6.6.13.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

6.6.14 Customize Plot Data Input

6.6.14.1 Smoothed Data

```
GENERAL DESCRIPTION

This input group allows to smooth the data for customizing the plot data.
The level of smoothing can be adjusted by varying the sliding filter width.


SPECIAL NOTES/HINTS

- To use smoothed data, the left button must be pressed.


INPUT PARAMETER(S)

 1) === BUTTON for Use smoothed Data Choice ===

    Purpose:
       Allows to use smoothed data.

    Type:
       Button for activating the sliding filter width input field.

    Format/Usage:
       Press the selected button for activating the sliding filter width
       input field.
```

```
    Range of Values:
       On/off.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === INPUT FIELD for Sliding Filter Width selection ===

    Purpose:
       Allows to change the sliding filter width by keyboard input.

    Type:
       Text input field for input of the sliding filter width.

    Format/Usage:
       Put in the sliding filter width by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       Only odd numbers are allowed.

    Availability/Indirect Effects:
       Only available, if the button 'Use smoothed Data' was pressed.


INPUT EXAMPLE(S)

- Selecting sliding filter width of 7:
   Press the 'Use smoothed Data' button and then set the value of the
   sliding filter width input field to 7.
```

6.6.14.2 Statistics Data

```
GENERAL DESCRIPTION

This input group allows to calculate statistics data for customizing the
plot data. It is possible to calculate the average, the standard deviation
of the average and/or the standard deviation (absolute- and relative
standard deviation).


SPECIAL NOTES/HINTS

- Statistics data can only be calculated, if a statistics data file was
  selected from the data files list.


INPUT PARAMETER(S)

 1,2,3) === BUTTONS for Statistics Data Calculation Choice ===

    Purpose:
       Allows to calculate statistics data for customizing plot data.
       It is possible to calculate the average, the standard deviation
       of the average and/or the standard deviation.

    Type:
       Buttons for activating/deactivating the desired statistics function.

    Format/Usage:
       Press the selected button for activating/deactivating the desired
```

```
      statistics function.

   Range of Values:
      On/off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


 4) === DROPLIST for Absolute/Relative Standard Deviation Choice ===

   Purpose:
      Allows the selection between absolute- and relative standard
      deviation.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'Absolute StdDev' or 'Relative StdDev'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is always available.

INPUT EXAMPLE(S)

- Use relative standard deviation:
   Set droplist to 'Relative StdDev'.
```

6.6.14.3 Overplot Mean(s)

```
GENERAL DESCRIPTION

This input group allows to overplot mean(s) for customizing the plot data.
The parameter range can be adjusted by varying the lower and upper boundaries
of the parameter range interval.


SPECIAL NOTES/HINTS

- To use overplot mean(s), the left button must be pressed.


INPUT PARAMETER(S)

 1) === BUTTON for Overplot Mean(s) Choice ===

   Purpose:
      Allows to use overplot mean(s).

   Type:
      Button for activating the parameter range for mean input field.

   Format/Usage:
      Press the selected button for activation of the parameter range for
      mean input field.

   Range of Values:
```

```
      On/off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


 2) === INPUT FIELD for Parameter Range for Mean selection ===

   Purpose:
      Allows to change the lower and upper boundaries of the
      parameter range interval by keyboard input.

   Type:
      Text input field for input of the lower and upper boundaries of the
      parameter range interval.

   Format/Usage:
      Put in the lower and upper boundaries of the parameter range interval
      by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      ---

   Notes on Values:
      Only numbers and the dot at the correct position are allowed. The
      lower and upper boundary limit should be separated at least by a
      blank.

   Availability/Indirect Effects:
      Only available, if the button for overplot mean(s) was pressed.
```

INPUT EXAMPLE(S)

```
- Set impact parameter range for mean string to 6380.0 6450.0:
   Press the 'Overplot Mean(s)' button and then set the value of the
   impact parameter range for mean string to '6380.0 6450.0'.
```

6.6.14.4 Overplot Functional Fit(s)

GENERAL DESCRIPTION

This input group allows to overplot functional fit(s) for customizing the plot data. The parameter range for fits can be adjusted by varying the lower and upper boundaries of the parameter range interval. Fits can be selected between polynomial- and exponential fits. For polynomial fits, the order of the polynomial can be varied between 1st and the 5th order.

SPECIAL NOTES/HINTS

- To use overplot functional fit(s), the left button must be pressed.
- The order of the polynomial is only sensitive, if a polynomial fit is selected.

INPUT PARAMETER(S)

```
 1) === BUTTON for Overplot Functional Fit(s) Choice ===

   Purpose:
      Allows to use overplot functional fit(s).

   Type:
      Button for activating the parameter range for the
```

```
      fit input field and the fit method selection droplist.

   Format/Usage:
      Press the selected button for the activation of the parameter
      range for fit input field and for the fit method selection droplist.

   Range of Values:
      On/off.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


2) === INPUT FIELD for Parameter Range for Fit selection ===

   Purpose:
      Allows to change the lower and upper boundaries of the
      parameter range interval by keyboard input.

   Type:
      Text input field for input of the lower and upper boundaries of the
      parameter range interval.

   Format/Usage:
      Put in the lower and upper boundaries of the parameter range interval
      by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      ---

   Notes on Values:
      Only numbers and the dot at the correct position are allowed. The
      lower and upper boundary limit should be separated at least by a
      blank.

   Availability/Indirect Effects:
      Only available, if the button for overplot functional fit(s) was
      pressed.


3) === DROPLIST for Fit Method Choice ===

   Purpose:
      Allows the selection between polynomial fit and exponential fit.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following 2 values: 'Polynomial Fit' or 'Exponential Fit'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The droplist is only available, if the button for overplot functional
      fit(s) was pressed.


4) === INPUT FIELD to select the Order of the Polynomial ===

   Purpose:
      Allows to change the given order of the polynomial by keyboard input.
```

```
    Type:
       Text input field for input of the order of the polynomial.

    Format/Usage:
       Put in the selected order of the polynomial by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 1 to 5.

    Notes on Values:
       Only integer numbers allowed.

    Availability/Indirect Effects:
       Only available, if the fit method droplist was set to polynomial fit.


INPUT EXAMPLE(S)

- Set impact parameter range for fit string to 6380.0 6450.0:
   Press the 'Overplot Functional Fit(s)' button and then set the value
   of the impact parameter range for fit string to '6380.0 6450.0'.
```

6.6.14.5 Display Parameters

```
GENERAL DESCRIPTION

This input group allows to choose different sets of parameters for
customizing plot data. For phase as parameter to be visualized (valid for
FoMod/- or OSMod/Task-ids), L1-, L2-, LC-, and/or LI phase can be selected.
For ALoss as parameter to be visualized (valid only for FoMod/Task-ids), it
is possible to use L1- and/or L2 ALoss, whereas for power (available only
for OSMod/Task-ids) it is possible to use L1- and/or L2 power (as absolute
or relative power). For doppler shift as parameter to be visualized (possible
only for InRet/Task-ids) it is possible to choose among L1-, L2-, LC-, and/or
LI Dopp. One of the parameters must always be set. For bending, refractivity,
density, pressure, temperature, water vapor, specific humidity, total electron
content, doppler shift, and electron density (these parameters can only be
selected for InRet/Task-ids), the display parameters input group will be in-
sensitive because nothing can be adjusted in this case.


SPECIAL NOTES/HINTS

- The appearance of the display parameter field will automatically adjusted
  to include all necessary buttons and drop-lists for the chosen parameter
  to be visualized.


INPUT PARAMETER(S)

 1) === BUTTON(S) for Display Parameters Choice ===

    Purpose:
       Allows to activate/deactivate the different possible display
       parameters.

    Type:
       Buttons for activating/deactivating the different possible
       display parameters.

    Format/Usage:
       Press the selected button for activating/deactivating the different
       possible display parameters.

    Range of Values:
       On/off.
```

```
    Notes on Values:
       At least one button must be pressed.

    Availability/Indirect Effects:
       Always available. For bending, refractivity, density, pressure,
       temperature, water vapor, specific humidity, total electron content,
       doppler shift, and electron density (these parameters can only be
       selected for InRet/Task-ids) the display parameters input group will
       be insensitive.


 2) === DROPLIST for Absolute/Relative Power Choice ===

    Purpose:
       Allows the selection between absolute- and relative power.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 2 values: 'Absolute Power' or 'Relative Power'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The droplist is only available if power as parameter to be visualized
       was selected in the corresponding OSMod/Task-id.


INPUT EXAMPLE(S)

- Set display parameter to L2 ALoss:
   Press the L2 ALoss button (if L1 ALoss is already pressed click again
   on L1 ALoss to deactivate it).
```

6.6.14.6 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.6.15 PS File Output Input

6.6.15.1 PS File Output

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.9.1, titled "PS File Output" .

6.6.16 Colors Input

6.6.16.1 Color Tables

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.1, titled "Color Tables" .

6.6.16.2 Color Options

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.2, titled "Color Options" .

6.6.16.3 Color Function

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.3, titled "Color Functions" .

6.6.16.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.6.17 Annotate Input

6.6.17.1 Annotate Graphics Window Input

```
GENERAL DESCRIPTION

This input group allows to create additional text annotations in the
graphics window. First, a new text string can be written into the text
input field or chosen from the selected droplist and afterwards, the
size, direction and alignment of the text can be manipulated. The text
character set and colors are changeable, too. These entries can be further
adjusted by a special set of function buttons.


SPECIAL NOTES/HINTS

- To save the annotation settings, close the annotation input window with
  the Quit button or leave it without saving the new settings by pressing
  the Cancel button.


INPUT PARAMETER(S)

 1) === DROPLIST to Select Text Choice ===

    Purpose:
       Allows to choose an already added text entry as annotation
       text template. In the default state, no text entry is available
       and the droplist is set insensitive.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       All earlier added text string entries:

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available if at least one text string was added before.
```

```
2,3) === INPUT FIELDS for setting the Text Position ===

   Purpose:
      Allows to change the default x- and y-Text Position.

   Type:
      Editable Text input fields for changing the default text position.

   Format/Usage:
      Put the new x- and y-Text Positions in by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      All integer and real numbers between 0 and 1 (two digits after
      comma are allowed).

   Notes on Values:
      The x- and y-coordinates are normalized coordinates (beginning
      from 0 to 1). Zero in x means the left side (1 the right side),
      whereas 0 in y means the bottom and 1 denotes the upper boundary
      of the plot window.

   Availability/Indirect Effects:
      Always available.


4) === INPUT FIELD for Annotation Text String input ===

   Purpose:
      Allows to enter an annotation text string. The appearance of this
      text string can then be further manipulated by changing the text
      size, direction, alignment, character set and the text color.

   Type:
      Editable Text input field for entering an annotation text string.

   Format/Usage:
      Enter the annotation text string by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


5,6) === SLIDERS for changing the Text Size and Direction ===

   Purpose:
      These sliders allow to change the default text size and direction
      (the default text size is 1.5 and the default text direction is 0).

   Type:
      Sliders for changing the default text size and direction.

   Format/Usage:
      Click on and drag the slider with the mouse to the desired position
      (the text size number or the text direction number will be shown in
      the label right of the slider).

   Range of Values:
      The text size can vary from 0.5 to 5.0 (minimum adjustable step size
      is 0.5). The text direction can vary from 0 to 360 degrees (minimum
      adjustable step size is 10). The direction of the text rotation is
      in positive mathematical sense (0 is the normal horizontal text
      position, whereas 90 degrees denotes the vertical text position and
```

```
      so on).

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


7,8,9) === Exclusive BUTTONS for setting the Text Alignment ===

   Purpose:
      These exclusive buttons allow to select among three different
      text alignment positions.

   Type:
      Exclusive Buttons for selecting the correct text alignment.

   Format/Usage:
      Press the button which causes to activate the selection among
      three different text alignment positions.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


10) === DROPLIST for  Character Set Choice ===

   Purpose:
      Allows to choose among several different character sets for
      the annotation text string.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following values: 'Simplex Roman', 'Simplex Greek',
      'Duplex Roman', 'Complex Roman', 'Complex Greek', 'Complex Italic',
      'Math/special', 'Special characters', 'Gothic English', 'Simplex
      Script', 'Complex Script', 'Gothic Italian', 'Gothic German',
      'Cyrillic', 'Triplex Roman', 'Triplex Italic'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


11) === DRAW WIDGET for selecting the Annotate Text Color ===

   Purpose:
      This draw window allows to select the annotation text color.

   Type:
      Draw widget.

   Format/Usage:
      Click with the left mouse button on the desired color field
      to change the color of the annotation text.
```

```
    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 12,13,14,15,16,17) === BUTTONS for Text Entry Modifications ===

    Purpose:
       These six buttons allow to modify the present status of the
       annotation text entries, to show the whole entry content, to
       change entries, to delete individual entries, to delete all
       of them at once, or to erase the annotation text string in the
       graphics window.

    Type:
       Buttons for starting the desired action.

    Format/Usage:
       Press the button for activating the chosen function.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The Add Entry button is always available whereas the rest of
       the entry buttons (Change Entry, Delete Entry, Delete All, and
       View All) are only sensitive, if at least one entry exists. The
       Erase button is sensitive, if an annotation text is already
       displayed in the graphics window.


 18,19) === BUTTONS for Quit or Cancel ===

    Purpose:
       Pressing the Quit button saves the actual state of the
       annotation window and closes it, whereas pressing the
       Cancel button closes the annotation window without any
       other action.

    Type:
       Buttons for starting the desired action.

    Format/Usage:
       Press the button for activating the chosen function.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Create annotation text string:
   Click with the mouse into the text input field and write the
   chosen text string.

- Change the annotation text string direction to vertical:
   Move the text direction slider to position 90 (degrees).
```

- Alter the color of the annotation text string to blue:
  Click on the blue color patch of the select color draw field.

6.7 Visualize Volume Data

6.7.1 Visualize Volume Data

GENERAL DESCRIPTION

The "Visualize Volume Data" window interface is called via the "Volume Data..." entry of the "Visualize/Validate" menu. Its operation is independent of whether a project is currently opened or not.

The interface allows to compute, visualize, and print-out "volume data". Such "volume data" within EGOPS are arbitrary 3D subdomain cubes, cut out of the generic 5D space-time domain (height-latitude-longitude-UT-month) of EGOPS' atmospheric model parameters or the generic 6D space-time domain (height-latitude-longitude-UT-month-solar activity) of EGOPS' ionospheric model parameters, respectively. Cube dimensions up to 101x101x101 data points are allowed, and the volume data may be extracted from any of the atmospheric/ionospheric models available within EGOPS.

The atmospheric parameters available include temperature, pressure, density, refractivity, water vapor (pressure), and specific humidity. The ionospheric parameters include electron density and ionospheric refractivity (at the GPS/L1 frequency).

The preparation of the volume data sets is performed within a processing pop-up window of the interface, which is accessed via the "Compute 3D Atm/Ion Model Data..." button.

The computed volume data are saved in "display files" (under the /referdata/volumdata subdirectory of EGOPS) which are named with the acronym of the atmosphere/ionosphere model from which they originate plus the acronym of the parameter concerned. The filename extension indicates the data type ("Vol") and the version. For instance, "MSIS90_DMI-Temp.Vol01" contains data from the 1st computation of a specific model and parameter ("01") and a 3D subdomain cube of temperature from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed so far are basically available to be visualized. For visualizing a specific volume data set, the User needs to first select the parameter desired (either an atmospheric or ionospheric one) and then a "display file" desired (out of all available ones for the selected parameter, which typically may cover different models and versions). The visualization itself is performed in form of arbitrary 2D slices taken out of the selected 3D subdomain cube which are depicted as contoured images.

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the dimension which is held fixed and its fixed value (the 2D slice spanned by the other two orthogonal dimensions is singled out just at this value), the axes ranges of the 2D slice, and the contour levels to be shown. However, these plot settings can also be adjusted by the User before plotting.

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization. EGOPS V4.0

allows additionally to switch between the image/contours or the contour fill mode for plotting. Also several different contour line colors are available for an easier line recognition.

A very useful new feature is the profiles pop-window for showing horizontal- or vertical volume data profiles. To create the volume data profiles the mouse cursor has to be moved over the whole volume data plot. Then the data profile will be simultaneously displayed in an extra graphic pop-window beside the standard volume data graphics window. It can be switched (via mouse click) between an horizontal- or an vertical data profiles mode and, at any time during visualization, the volume data profile can be saved to disk.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /referdata/volumdata subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Volume Data" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Pop-up the interface, prepare some volume data sets, and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

6.8 Visualize Volume Data Input

6.8.1 Compute 3D Atmosphere/Ionosphere Model Data

GENERAL DESCRIPTION

Pressing the 'Compute 3D Atmosphere/Ionosphere Model Data' button opens a pop-up window to select between several different atmosphere/ionosphere models and parameters, to prepare the atm/ion model data input and to compute the resulting atm/ion maps data files.

SPECIAL NOTES/HINTS

- The 'Compute 3D Atmosphere/Ionosphere Model Data Button' is always available.

INPUT PARAMETER(S)

1) === BUTTON for opening Compute 3D Atm/Ion Model Data Pop-up Window ===

Purpose:
This pop-up window allows to select between several different atmosphere/ionosphere models and parameters, to prepare the atm/ion model data input and to compute the resulting atm/ion maps data files.

Type:
Button for opening the 'Compute 3D Atmosphere/Ionosphere Model Data pop-up window.

Format/Usage:

Press the button to open the pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
The 'Compute 3D Atmosphere/Ionosphere Model Data' button is always available.

INPUT EXAMPLE(S)

- Opening compute 3D atmosphere/ionosphere model data pop-up window:
  Click on the 'Compute 3D Atm/Ion Model Data...' button to open the pop-up window.

6.8.2 Display 2D Slice(s) through Volume Data

GENERAL DESCRIPTION

This input allows to choose between 6 atmosphere- and 2 ionosphere parameters for visualization. Parameters for atmosphere visualization are temperature, pressure, density, refractivity, water vapor and specific humidity, or electron density and ionosphere refractivity for ionosphere visualization.

SPECIAL NOTES/HINTS

- The droplist for atm/ion parameter to be visualized is always available.

INPUT PARAMETER(S)

1) === DROPLIST for selection of Atm/Ion Parameter to be Visualized ===

Purpose:
Allows to choose between temperature, pressure, density, refractivity, water vapor, and specific humidity as atmosphere parameters or electron density and ionosphere refractivity as ionosphere parameters to be visualized.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following values: 'Temperature', 'Pressure', 'Density', 'Refractivity', 'Water Vapor', 'Sp. Humidity', 'Elec. Density', 'Ion. Refract.'.

Notes on Values:

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Set ion parameter to be visualized to ionosphere refractivity:
  Select 'Ion. Refract.' on the atm/ion param. to be visualized droplist.

6.8.3 Display Data Files

GENERAL DESCRIPTION

This list widget shows a list of all preselected atmosphere/ionosphere volume data files for plotting. If no file is preselected or found, the list widget will be insensitive. To select a file for plotting, double click on a listed filename with your mouse.

SPECIAL NOTES/HINTS

- Only one file at a time can be selected.

INPUT PARAMETER(S)

```
 1) === File LIST for plot file selection ===

    Purpose:
       Allows to select a file (from the file list) for plotting.

    Type:
       List for selecting a file for plotting.

    Format/Usage:
       Double click with your mouse on a listed filename to select it.

    Range of Values:
       All listed filenames.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       If no file is preselected or found, the list will be insensitive.
```

INPUT EXAMPLE(S)

- Choose Filename.Vol01 for plotting:
  Double click with your mouse on the list entry for Filename.Vol01

6.8.4 Plot Settings

GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible to modify the plot title, the legend text, to choose a dimension for 2D slices, to zoom in and out of the plot window, to select parameter axis ranges and to set the slicer value (position) and to change the parameter contour range/separation. The type of axis ranges cannot be changed, these are fixed after selecting one of the three axises for slicing (if another configuration is needed, it must be prepared separately by using the compute 3D atm/ion model data pop-up window).

SPECIAL NOTES/HINTS

- The plot settings input window is only sensitive, if a file from the display data files list was already selected.

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for setting the Plot Title ===

    Purpose:
```

Allows to change the default plot title setting.

Type:
Editable Text input field for setting the plot title.

Format/Usage:
Make necessary changes to the plot title by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
All alphanumeric strings with a maximum length of 60 characters.

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

2) === BUTTON for opening Legend Text Pop-up Window ===

Purpose:
The pop-up window allows to change the default legend text.

Type:
Button for opening legend text pop-up window.

Format/Usage:
Press the button for opening the legend text pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

3) === DROPLIST for selection of Fixed Dimension for 2D Slices ===

Purpose:
Allows to select the fixed dimension for 2D slices.
Possible grid parameters are: Height, Latitude, Longitude, Universal Time, Month, Solar Activity (any combination from 3 of these parameters are possible for Ionosphere models; for Atmosphere models, solar activity is not used).

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following values: 'Hei', 'Lat', 'Lon', 'UTi', 'Mon', 'SAc'.

Notes on Values:

Availability/Indirect Effects:
Always available if the plot setting window is sensitive.

4) === BUTTON for Zooming in a specified Plot Area ===

Purpose:
This button allows to select a specific plot region for zooming.

```
   Type:
      Button for activating the graphic cursor in the draw window which
      allows to select a rectangular field for zooming.

   Format/Usage:
      Press the 'Zoom in...' button to activate the graphic cursor in
      the plot window. Draw a rectangle with the graphic cursor by
      constantly pressing the left mouse button while moving the mouse
      to create the zoom frame. Zoom the chosen area by clicking the
      'Plot' button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available, if the plot setting window is sensitive and
      a plot was already displayed before in the plot window.


5) === BUTTON for Restoring the original Plot Size ===

   Purpose:
      This button allows to restore the plot size.

   Type:
      Button for activating the restore function.

   Format/Usage:
      Press the 'Restore' button and afterward the 'Plot' button to
      restore the zoomed plot image to its original size.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the 'Zoom in...' button was pressed before.


6,7,8,9) === INPUT FIELDS for Axis Rang., Slice Value & Cont. Ran./Sep. ===

   Purpose:
      Allows to modify the preselected values of the parameter axis ranges
      (lower and upper boundaries). In case of the slice value, the position
      of the slicer can be varied and for the chosen atm/ion parameter to
      be visualized, the contour range/separation input field allows adjust-
      ments of the lower and higher boundaries and the contour line separa-
      tion.

   Type:
      Text input fields for inputs of parameter axis range, slicer position
      and parameter contour range/separation values.

   Format/Usage:
      Set the lower and upper boundaries of the parameter axis ranges
      (lo hi), the slicer position value as well as the parameter contour
      line lower and higher boundaries and line separation (lo hi sep) by
      keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      For the parameter axis ranges, the lower (upper) boundary and the
      slicer value can only be adjusted in discrete steps (stepsize is
      given in parentheses).
```

```
    Notes on Values:
       Only numbers and dots in the correct position are allowed. Different
       values must be separated at least by a blank.

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

```
- Show legend text pop-up window:
   Press legend text button.

- Set fixed dimension for 2D slice to month:
   Select 'Mon' on Fixed Dimension for 2D Slice droplist.

- Zoom in an interesting area of a 2D Slice:
   Click on the 'Zoom in...' button. Move the graphics cursor to the
   interesting spot of the 2D slice and then draw a rectangle over
   this area by constantly pressing the left mouse button while moving
   the mouse to create the zoom frame. To zoom into this region, press
   the 'Plot' button afterwards.
```

6.8.5 Plot Window

GENERAL DESCRIPTION

This input group allows to specify various plot settings. It is possible to specify the number of plots to be shown in the plot window (the plot window can be split into one, two or four plot areas), to overplot another plot over the first one, to erase the last plot or to erase the full plot window, to print the content of the plot window to a PS-file, to change the Image/Contours and Contours color and to adjust plot colors. The Profiles... button opens a special pop-up window which allows to visualize data profiles by moving the mouse cursor over the volume data plot.

SPECIAL NOTES/HINTS

- The plot window droplist and buttons are only sensitive, if a file from the display data files list was already selected.
- Overplot and to PS file button are only sensitive, if a plot is already displayed in the plot window.

INPUT PARAMETER(S)

```
 1) === DROPLIST for Plot Panels Choice ===

    Purpose:
       Allows to choose among three different plot window settings.
       Default setting is one display panel, but the two and four display
       panel setting is also available.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 3 values: 'One Display Panel', '2 Display
       Panels', and '4 Display Panels'.

    Notes on Values:
       ---
```

```
   Availability/Indirect Effects:
      Always available, if a file from the display data files list was
      already selected for plotting.


2,3) === BUTTONS for Plot and Overplot ===

   Purpose:
      To plot the chosen data file or to overplot a selected data file
      over an existing plot.

   Type:
      Button for plotting (overplotting) a selected data file.

   Format/Usage:
      Press the button to plot (overplot) the selected data file.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Plot button is available, if a file from the display data files list
      was already selected for plotting. Overplot button is only sensitive,
      if a plot already exists on the plot window (i.e. the plot button must
      have been pressed before). The maximum number of plots is restricted
      to 20 plots for the  whole plot window (for a one panel plot that means
      a maximum of 19 over-plots are possible, for a two panel plot,
      18 over-plots arbitrarily split between the two main plots are
      possible).


4,5) === BUTTONS for Erase Last and Erase All ===

   Purpose:
      For erasing the last plot of a multi-panel plot window or for completely
      erasing the whole plot window.

   Type:
      Button to erase the last plot or the whole plot window content.

   Format/Usage:
      Press the 'Erase Last' button to erase the last plot of a multi-panel
      plot window or to erase the whole plot window with the 'Erase All'
      button.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Erase Last (All) button is available, if a file from the display data
      files list was already selected for plotting.

6) === BUTTON for printing Plot Window content to PS file ===

   Purpose:
      The 'To PS File' button opens a pop-up window for printing the
      content of the plot window to a PS-file for. The name of the PS file,
      the size of the plot (DIN-A4 or letter format), framed or unframed
      plot and the kind of PS plot file (standard or encapsulated PS) can
      be specified.

   Type:
      Button to open pop-up window for PS file output adjustments.

   Format/Usage:
```

Press the button to open the To PS file pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
To PS File button is only available, if a file from the display data files list was already plotted.

7) === DROPLIST for Image/Contours Choice ===

Purpose:
Allows to choose between two different plot color modes (the Image/Contours or the Contour Fill mode).

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following two values: 'Image/Contours', or 'Contour Fill'.

Notes on Values:

Availability/Indirect Effects:
Always available, if a file from the display data files list was already selected for plotting.

8) === DROPLIST for Contour Lines Color Choice ===

Purpose:
Allows to choose among six different contour line color settings.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following six values: 'Def. Contours', 'White Contours', 'Black Contours', 'Red Contours', 'Green Contours', 'Blue Contours'.

Notes on Values:

Availability/Indirect Effects:
Always available, if a file from the display data files list was already selected for plotting.

9) === BUTTON for Colors Choice ===

Purpose:
For changing the plot colors and fine tuning their characteristics (to learn more about color manipulation, please read the help entry for the colors pop-up window).

Type:
Button to open the plot color selection window and for fine tuning of the plot color characteristics.

```
    Format/Usage:
       Press the button to open the colors pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Colors button is only available, if a file from the display data
       files list was already selected for plotting.


 10) === BUTTON for Profiles Choice ===

    Purpose:
       For showing horizontal- or vertical volume data profiles. To show
       the volume data profiles, move the mouse cursor over the volume data
       plot. Press the right mouse button to switch between horizontal- and
       vertical data profiles mode. Press the middle mouse button (or press
       the left and right mouse button simultaneously) to save the profile.
       Volume data profiles will be saved in the ../../referdata/volumdata
       directory. To quit the profiles view, window press the left mouse
       button.

    Type:
       Button to open the Profiles View pop-up window.

    Format/Usage:
       Press the button to open the Profiles View pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The Profiles... button is only sensitive, if a file from the display
       data files list was already plotted. In case of a two or four panel
       plot window the Profiles... button is always insensitive.


INPUT EXAMPLE(S)

- Set display droplist to 4 panels display:
   Click on '4 Display Panels'.

- Open the to PS file pop-up window:
   Press 'to PS file...' button.
```

6.8.6 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.8.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.8.8 Prepare Atmosphere/Ionosphere Volume Data Input

6.8.8.1 Atmosphere/Ionosphere Model and Parameter Selection

```
GENERAL DESCRIPTION

This input group allows to choose Atmosphere and Ionosphere Models and
atmospheric (ionospheric) Parameters. Six different Atmosphere Models
(Bi-Exponential-, HLat 2D-, 3D dry-, GCM 3D-, HiVRes-, and a User-
supplied Atmosphere) and two Ionosphere Models (Double-Chapman- and a
3D Ionosphere) Models are available. Selectable parameters for
Atmosphere Models are temperature, pressure, mass density, refractivity,
water vapor pressure, and specific humidity, whereas for Ionosphere
Models, electron density and ionosphere refractivity can be selected.


SPECIAL NOTES/HINTS

- The Atmosphere (Ionoshper) Parameter droplist button is only available
  in case an Atmosphere (Ionosphere) model was selected.


INPUT PARAMETER(S)

 1) === DROPLIST for Atmosphere/Ionosphere Model Choice ===

    Purpose:
       Allows to select among six different Atmosphere Models (Bi-
       Exponential-, HLat 2D-, 3D dry-, GCM 3D-, HiVRes-, and a User-
       supplied Atmosphere) and two Ionosphere Models (Double-Chapman-
       and a 3D Ionosphere).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following eight values: 'Bi-Exponential Atm. (RefAtm_UoG)',
       'HLat 2D Atmosphere (CIRA86aQ_UoG)', '3D Atmosphere dry (MSIS90_DMI)',
       'GCM 3D Atmosphere (GCM3DAtm)...', 'HiVRes Atmosphere (HiVResAtm)...',
       'User-supplied Atm. (RefAtm_UoG)', 'Double-Chapman Ion. (RefIon_UoG)',
       '3D Ionosphere (Iono3D_UoG)'.

    Notes on Values:
       Selecting the GCM 3D or the HiVRes Atmosphere opens an extra pop-up
       window for GRIB (Raob) data file path and name input.

    Availability/Indirect Effects:
       The droplist is always available.


 2) === DROPLIST for Atmosphere/Ionosphere Parameter Choice ===

    Purpose:
       Allows to select between temperature, pressure, mass density,
       refractivity, water vapor pressure, and specific humidity in case
       of Atmosphere Parameter and electron density and ionosphere refrac-
       tivity in case of Ionosphere Parameter.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.
```

```
    Range of Values:
       One of the following values for Atm. Parameter: 'Temperature (Temp)',
       'Pressure (Pres)', 'Mass Density (Dens)', 'Refractivity (Refract)',
       'Water Vapor Pres. (Wvap)', 'Specific Humidity (SpHumid)'.
       One of the following two values for Ion. Parameter: 'Electron Density
       (ElDens)', 'Ion.Refract.-GPS/L1 (IonRefr)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The Atm. (Ion.) Parameter droplist is only available, if an Atmosphere
       (Ionosphere) Model was selected from the Atm/Ion Model droplist.


INPUT EXAMPLE(S)

- Selecting pressure as atmosphere parameter:
   Select 'Pressure (Pres)' from the Atm. Parameter droplist.
```

6.8.8.2 Atmosphere/Ionosphere Model Data Preparation Input

```
GENERAL DESCRIPTION

This input group allows to manipulate the Height, Lat- and Lon Grid,
UT, Month and, for an Ionospher Model, the Solar Activity/F107 index.


SPECIAL NOTES/HINTS

- Sol.Act./F107 is only sensitive, if an Ionosphere Model was selected.


INPUT PARAMETER(S)

 1,2,3) === DROPLISTS for Fixed Dimension Choice ===

    Purpose:
       Allows to fix 3 from the 6 underlying dimensions. The left droplist
       allows to select height, latitude, longitude, and universal time.
       The parameter list in the middle droplist depends on selection made
       in the left droplist (if height was selected, then the parameter list
       in the middle droplist is set to latitude, longitude, universal time,
       and month; if latitude was selected, then the list provides longitude,
       universal time, and month and so on). The right droplist is not
       applicable (N/A) for an atmosphere model. For an ionosphere model,
       the parameters of the right droplist depend on the setting of the
       middle droplist (if latitude was selected, then the parameter list
       is set to longitude, universal time, month, and solar activity index;
       if longitude was selected, then the list shrinks to universal time,
       month, and solar activity index and so on).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 4 values for the left droplist: 'Hei', 'Lat',
       'Lon', 'UTi'.
       One of the following 4 values for the middle droplist: 'Lat', 'Lon',
       'UTi', 'Mon'.
       One of the following 4 values for the right droplist: 'Lon', 'UTi',
       'Mon', 'SAc'.

    Notes on Values:
       The actual parameter length of the middle (right) droplist depends
```

```
      on the setting of the left (middle) droplist.

   Availability/Indirect Effects:
      The droplists are always available.


4) === INPUT FIELD for Height (Grid) Choice ===

   Purpose:
      Allows to change the shown (default) height (grid) by keyboard
      input.

   Type:
      Text input field for input of the height (grid).

   Format/Usage:
      Make changes of the given height (grid) by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      From 0 to 20000 km.

   Notes on Values:
      Only numbers with a maximum of one post comma digit and blanks to
      separate the different values (in case of height grid) are
      allowed.

   Availability/Indirect Effects:
      Always available.


5,6) === INPUT FIELDS for input of the Lat/Lon (Grid) Choice ===

   Purpose:
      Allows to change the shown (default) latitude/longitude (grid) by
      keyboard input.

   Type:
      Text input fields for input of the latitude/longitude (grid).

   Format/Usage:
      Make changes of the given latitude/longitude (grid) by keyboard
      input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      For latitude from -90 to 90 deg, for longitude from -180 to 180 deg.

   Notes on Values:
      Only numbers with a maximum of one post comma digit and blanks to
      separate the different values (in case of latitude/longitude grid)
      are allowed.

   Availability/Indirect Effects:
      Always available.


7) === INPUT FIELD for UT (Grid) Choice ===

   Purpose:
      Allows to change the shown (default) universal time (grid) by
      keyboard input.

   Type:
      Text input field for input of the universal time (grid).

   Format/Usage:
      Make changes of the given universal time (grid) by keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
```

From 0 to 24 hours (0 to 59 minutes).

Notes on Values:
Only numbers with a maximum of one post comma digit and blanks to separate the different numbers (in case of universal time grid) or integer numbers (in case of universal time) are allowed. Note that in case of universal time grid input the time are given in hours (with one post comma digit) whereas for normal universal time input the time format is hour and minute (hhmm).

Availability/Indirect Effects:
Always available.

8) === INPUT FIELD for Month (Grid) Choice ===

Purpose:
Allows to change the shown (default) month (grid) by keyboard input.

Type:
Text input field for input of the month (grid).

Format/Usage:
Make changes of the given month (grid) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
From 1 to 12.

Notes on Values:
The months are numbered (1=Jan,... 12=Dec). Only integer numbers are allowed.

Availability/Indirect Effects:
Always available.

9) === INPUT FIELD for Solar Activity/F107 (Grid) Choice ===

Purpose:
Allows to change the shown (default) solar activity/F107 index (grid) by keyboard input.

Type:
Text input field for input of the solar activity index (grid).

Format/Usage:
Make changes of the given solar activity index (grid) by key-board input.
Press <CR> to deliver the input to the system.

Range of Values:
From 75 to 220.

Notes on Values:
Only integer numbers are allowed.

Availability/Indirect Effects:
Only available, if an Ionosphere Model was chosen.

INPUT EXAMPLE(S)

- Select March as valid month:
  Set the Month input field to '3'.

6.8.8.3 Compute

```
GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calcu-
lation by employing the corresponding software package (in this case
written in IDL). It performs 3D atmosphere/ionosphere model data compu-
tations based on the current input and produces the necessary result file
for the subsequent visualization. (To learn more about the file structure
behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level
Help menu.) The name of the resulting atmosphere/ionosphere maps data
file will be shown in the input field below the compute button. It is not
possible to change the predefined resulting atm/ion maps data file name.
After starting a computation, an 'Information Window' pops up with a short
hint that EGOPS started atm/ion model data computing. When the calculation
is finished, the 'Information Window' will be closed.


SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges etc.)
  can result in very long computation times.


INPUT PARAMETER(S)

 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs 3D atmosphere/ionosphere
       model data computations based on the current input and produce the
       necessary result file for the subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user) the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Atm/Ion Maps Data Filename ===

    Purpose:
       Shows the predefined resulting atmosphere/ionosphere maps data
       filename.

    Type:
       Input field (non editable).
```

```
    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
   task you may have some time for other work now...)
```

6.8.8.4 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

6.8.8.5 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.8.8.6 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

6.8.8.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.8.9 Batch Job Input

6.8.9.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

6.8.9.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.8.9.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

6.8.10 Batch Processing Information

6.8.10.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.8.10.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

6.8.10.3 Terminate Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

6.8.10.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

6.8.10.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

6.8.10.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

6.8.11 PS File Output Input

6.8.11.1 PS File Output

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.9.1, titled "PS File Output" .

6.8.12 Colors Input

6.8.12.1 Color Tables

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.1, titled "Color Tables" .

6.8.12.2 Color Options

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.2, titled "Color Options" .

6.8.12.3 Color Function

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.3, titled "Color Functions" .

6.8.12.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.9 Visualize Data Animation

6.9.1 Visualize Data Animation

```
GENERAL DESCRIPTION

The "Visualize Data Animation" window interface is called via the
"Data Animation..." entry of the "Visualize/Validate" menu. Its operation
is independent of whether a project is currently opened or not.

The interface allows to compute and visualize (by animation) "volume data".
"Volume data" within EGOPS are arbitrary 3D subdomain cubes, cut out
of the generic 5D space-time domain (height-latitude-longitude-UT-month)
of EGOPS' atmospheric model parameters or the generic 6D space-time domain
(height-latitude-longitude-UT-month-solar activity) of EGOPS' ionospheric
model parameters, respectively. Cube dimensions of up to 101x101x101 data
points are allowed, and the volume data may be extracted from any of the
atmospheric/ionospheric models available within EGOPS.

The atmospheric parameters available include temperature, pressure, density,
refractivity, water vapor (pressure), and specific humidity. The ionospheric
parameters include electron density and ionospheric refractivity (at the
GPS/L1 frequency).

The preparation of the volume data sets is performed within a processing
pop-up window of the interface, which is accessed via the "Compute 3D
Atm/Ion Model Data..." button. (This pop-up window is in fact the identical
one as that accessed within the "Visualize Volume Data" interface.)

The computed volume data are saved in "display files" (under the
/referdata/volumdata subdirectory of EGOPS) which are named with the
acronym of the atmosphere/ionosphere model from which they originate
plus the acronym of the parameter concerned. The file name extension
indicates the type ("Vol") and the version. For instance,
"MSIS90_DMI-Temp.Vol01" contains data from the 1st computation of
```

a specific model and parameter ("01") a 3D subdomain cube of temperature values from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed are basically available to be visualized. For visualizing a specific volume data set, the User needs to first select the desired parameter (either an atmospheric or ionospheric one) and then a "display file" (out of all available ones for the selected parameter, which typically may cover different models and versions).

So far, the computation and selection of specific volume data is in fact identical to that within the "Visualize Volume Data interface. However, instead of enabling static display and print-out of 2D slices through the 3D subdomain cubes, this interface allows to animate arbitrary 2D slices through the 3D cubes along the 3rd dimension. In other words, selecting one dimension as the "time axis" of the "movie" (along which the animation will proceed), one can visually explore the 3D cube in terms of motion pictures, the pictures given by the 2D slices orthogonal to the "time axis". The 2D slices are depicted as 2D images with or without contours. Thus, this interface is an ideal tool for very effectively learning about the space/time behavior of EGOPS' atmosphere/ionosphere models.

After having selected a "display file", an immediate start of the animation is possible, kicking off the "loading" of 2D slices into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the dimension along which the animation shall proceed (the 2D slices spanned by the other two orthogonal dimensions will then constitute the motion pictures), the range of values along the animation dimension, the axes ranges of the 2D slices, and the contour levels to be shown (default is no contour levels). However, these plot settings can also be adjusted by the User before starting the animation.

The graphics output window, after having started the animation and loaded the relevant 2D slices, shows the animation while it can be customized by a series of convenient functions. These include backward, forward, bounce, and pause modes, movie speed regulation, real-time slice number information, and arbitrary browsing through the slice series by step-by-step inspection. In addition, a "Colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately effect the current graphics, allowing for efficient color optimization. "Stop" and "Erase" functions complete the primary features, allowing for stopping and clearing up a current animation.

EGOPS allows additionally to switch between the image/contours or the contour fill mode for data animation. The color/volume or color/slice are two different animation color range modes. In the color/volume mode, the colors for each slide are physically compatible (the same data value in each slide has the same color), whereas in the color/slice mode, the full color range is used for each individual slice, which means that the colors for different slices can have different meanings. Also several different contour line colors are available for an easier line recognition.

The "MPEG Output" function conveniently allows to save the currently loaded data animation sequence as an MPEG video file. In this form the data video file can be easy transferred to another users (which don't need EGOPS to run the animation, only a common MPEG player is necessary for replaying the animated data sequence).

[Detailed help on each function of the "Visualize Data Animation" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Pop-up the interface, prepare some volume data sets, and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

6.10 Visualize Data Animation Input

6.10.1 Compute 3D Atmosphere/Ionosphere Model Data

```
GENERAL DESCRIPTION

Pressing of the compute 3D atmosphere/ionosphere model data button opens a
pop-up window. This pop-up window allows to select amongst several different
atmosphere/ionosphere models and parameters, to prepare the atm/ion model
data input and finally to compute the resulting atm/ion maps data files.


SPECIAL NOTES/HINTS

- The compute 3D atmosphere/ionosphere model data button is always available.


INPUT PARAMETER(S)

 1) === BUTTON for opening Compute 3D Atm/Ion Model Data Pop-up Window ===

    Purpose:
       This pop-up window allows to select among several different
       atmosphere/ionosphere models and parameters, to prepare the atm/ion
       model data input and finally to compute the resulting atm/ion maps
       data files.

    Type:
       Button for opening the compute 3D atmosphere/ionosphere model data
       pop-up window.

    Format/Usage:
       Press the 'Compute 3D Atmosphere/Ionosphere Model Data' button to
       open the pop-up window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Button is always available.


INPUT EXAMPLE(S)

- Opening compute 3D atmosphere/ionosphere model data pop-up window:
   Click on the 'Compute 3D Atm/Ion Model Data...' button to open the
   desired pop-up window.
```

6.10.2 Animate 2D Slice(s) through Volume Data

```
GENERAL DESCRIPTION

This input allows to choose amongst 6 different atmosphere- and 2 ionosphere
parameters for visualization. Parameters for atmosphere visualization are
temperature, pressure, density, refractivity, water vapor, and specific
humidity, whereas electron density and ionosphere refractivity are the two
possible parameters for ionosphere visualization.


SPECIAL NOTES/HINTS
```

```
- The atm/ion parameter to be visualized droplist is always available.


INPUT PARAMETER(S)

 1) === DROPLIST for selection of Atm/Ion Parameter to be Visualized ===

    Purpose:
       Allows to choose among temperature, pressure, density, refractivity,
       water vapor, and specific humidity as atmosphere parameters or electron
       density and ionosphere refractivity as ionosphere parameters to be
       visualized.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following values: 'Temperature', 'Pressure', 'Density',
       'Refractivity', 'Water Vapor', 'Sp. Humidity', 'Elec. Density',
       'Ion. Refract.'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Set ion parameter to be visualized to ionosphere refractivity:
   Select 'Ion. Refract.' on the atm/ion param. to be visualized droplist.
```

6.10.3 Display Data Files

```
GENERAL DESCRIPTION

This list widget shows a list of all preselected atmosphere/ionosphere
volume data files for animation. If no file is preselected or found, the
list widget will be insensitive. From this list, a file can be selected
for animation by double clicking the listed filename with the mouse.


SPECIAL NOTES/HINTS

- Only one file at the same time can be selected.


INPUT PARAMETER(S)

 1) === File LIST for plot file selection ===

    Purpose:
       The file list allows to select a file for animation.

    Type:
       List for selecting a file for animation.

    Format/Usage:
       Double click with the mouse on the listed filename to select it.

    Range of Values:
       All listed filenames.

    Notes on Values:
```

```
        ---

    Availability/Indirect Effects:
        If no file is preselected or found, the list will be insensitive.
```

INPUT EXAMPLE(S)

```
- Choose filename.Vol01 for animation:
   Double click with your mouse on filename.Vol01
```

6.10.4 Animation Settings

GENERAL DESCRIPTION

This input group allows to choose among various animation settings.
The following settings can be modified: the plot title, the legend text, the dimension to be animated, the behavior of the color range (full color range set for every individual slide or full color range set over the whole volume set of slices), the parameter axis ranges, the animation range and animation step size and the visualized parameter contour range/separation.
The type of the axis ranges cannot be changed because they are fixed after the selection of one of the three axis as the animation dimension (if another configuration is be needed, it must be prepared separately by using the compute 3D atm/ion model data function).

SPECIAL NOTES/HINTS

- The animation settings input window is only sensitive after a file was selected from the display data files list.

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for showing the Plot Title ===

    Purpose:
       Allows to change the default plot title setting.

    Type:
       Editable Text input field for showing and changing the plot title.

    Format/Usage:
       Make necessary changes of the plot title by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All alphanumeric strings with a maximum length of 60 characters.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available if the plot setting window is sensitive.


 2) === BUTTON for opening Legend Text Pop-up Window ===

    Purpose:
       The pop-up window allows to change the default legend text.

    Type:
       Button for opening the legend text pop-up window.

    Format/Usage:
       Press the button for opening the legend text pop-up window.
```

```
   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


3) === DROPLIST for selection of Dimension to be Animated ===

   Purpose:
      Allows to choose the dimension to be animated amongst the 3
      selected (selected in the atm/ion model data preparation input
      window) grid parameters. Possible grid parameters are:
      Height, Latitude, Longitude, Universal Time, Month, Solar Activity
      (every combination of 3 of these parameters is possible for Iono-
      sphere models; for Atmosphere models, solar activity can not be
      used).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following values: 'Hei', 'Lat', 'Lon', 'UTi', 'Mon',
      'SAc' (for each case, 3 of them are available for the animation
      dimension selection).

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


4) === DROPLIST for selection of Colors per Slice or Volume ===

   Purpose:
      Allows to optimize the use of the available color range for
      the whole animation sequence by using 'Colors/Volume' or
      to use the available color range for each slide individually
      by setting 'Colors/Slide'.

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following values: 'Colors/Volume', 'Colors/Slice'.

   Notes on Values:
      Only the colors/volume setting can ensure a 'true color dis-
      persion' over the whole animation sequence (i.e. the red color
      part of the animated dimension in slide 1 has exactly the same
      physical meaning (value) than the equal red color area in slide
      2 etc.). With colors/slide, only an animation with contour range
      lines gives information on the absolute values.

   Availability/Indirect Effects:
      Always available if the plot setting window is sensitive.


5,6,7) === INPUT FIELDS for Axis Ranges and Animation Dim. Range/Step ===
```

```
    Purpose:
       Allows to modify the preselected values of the parameter axis ranges
       (lower and upper boundaries). For the animation dimension the
       step size can be adjusted, whereas for the other parameter axis the
       step size is fixed (see information label right of the input field).

    Type:
       Text input fields for input of parameter axis range and animation
       dimension range and step.

    Format/Usage:
       Put in the lower and upper boundaries of the parameter axis ranges
       and of the animation dimension (lo hi), by keyboard input (for the
       latter, specify also the step size).
       Press <CR> to deliver the input to the system.

    Range of Values:
       For the parameter axis ranges and the animation dimension range, the
       lower (upper) boundary can only be adjusted in discrete steps (step
       size is given in parentheses).

    Notes on Values:
       Only numbers and dots in the correct position are allowed.
       The individual values must be separated at least by a blank.

    Availability/Indirect Effects:
       Always available.


 8,9) === BUTTON and INPUT FIELD for Parameter Contour Range/Separation ===

    Purpose:
       Allows to activate (deactivate) the parameter contour range/separation
       input field. The parameter contour range/separation input field can be
       used to modify the preselected values of the lower and upper boundary
       and the contour line separation.

    Type:
       Button for activating and Text Input Field for input of parameter
       contour range/separation values.

    Format/Usage:
       Press the button to activate the parameter contour range/separation
       input field. Then put in the lower and upper boundaries of the para-
       meter contour range/separation and the contour line separation size
       (lo hi sep) by keyboard input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       Only numbers and dots in the correct position are allowed.
       The individual values must be separated at least by a blank.

    Availability/Indirect Effects:
       Button is always available. Input field is only sensitive, if the
       Contour button has been activated.


INPUT EXAMPLE(S)

- Show legend text pop-up window:
   Press legend text button.

- Set dimension to be animated to month:
   Select 'Mon' on Dimension to be Animated droplist.
```

6.10.5 Animation Window

GENERAL DESCRIPTION

This input group allows to select several data animation functions. The start button begins loading of the slices whereas the stop button can be used to interrupt the loading process anytime and for ending an animation session. A group of 4 bitmap buttons are for reverse play, pause, forward and cycle play. Use them to select an animation direction or to pause the animation and view specific frames. A slider is available to set the animation speed. Moving it to the far right selects the maximum animation speed (the maximum speed depends on the used computer hardware and on the individual slice size). A frame selection slider can be used to view single frames from the whole animation data set (the animation must be paused for using the frame selection slider). The colors button opens a plot colors pop-up window for manipulating and adjusting the plot colors whereas the erase button is used to clean the plot window manually. A droplist/button group allows to change the Image/Contours and Colors/Slice, and the Contours Colors. The MPEG Output... button opens a pop-up window for saving the loaded animation as an MPEG-Video.

SPECIAL NOTES/HINTS

- The animation window buttons and sliders are only sensitive, if a file from the display data files list was already selected.

INPUT PARAMETER(S)

1,2) === BUTTONS for Start and Stop ===

Purpose:
The start button is for loading of the slices, whereas the stop button can be used to interrupt the loading process anytime and for ending an animation session.

Type:
Buttons for starting (stopping) slices loading and ending the animation session.

Format/Usage:
Press the button to start (stop) loading slices or to end the animation session.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
Start button is available, if a file from the display data files list was selected for animation. The stop button is only available, if the start button was pressed.

3,4,5,6) === BITMAP BUTTONS for Reverse Play, Pause, Forward Play and Cycle ===

Purpose:
These 4 bitmap buttons are for reverse play, pause, forward play and cycle. Use them to select an animation direction or to pause the animation and view specific frame images.

Type:
Bitmap Buttons for reverse play, pause, forward play and cycle.

Format/Usage:
Press the selected bitmap button to activate the desired function.

```
   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The 4 bitmap buttons are available if at least two slides have been
      loaded (by pressing the start button before).


7) === SLIDER for Animation Speed Control ===

   Purpose:
      To control the speed of the animation. Moving it to the far right is
      one hundred percent, as fast as the animation can go (the number of
      slices/second are shown in the label above the slider).

   Type:
      Slider to adjust the animation speed.

   Format/Usage:
      Click on and drag slider with the mouse to the desired position.

   Range of Values:
      Depends on the speed of your computer.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The slider is only available, if at least two slides have been loaded
      (by pressing the start button before).


8,9) === BUTTON and SLIDER for Viewing Single Animation Frames  ===

   Purpose:
      The button is to activate (deactivate) the underlying slider. This
      slider can be used to view single frames from the animation. To use
      the frame selection slider, the animation must be paused.

   Type:
      Button to activate (deactivate) the underlying slider.
      Slider to view single frames from the animation.

   Format/Usage:
      Press the button to activate the slider. Then click on and drag slider
      with the mouse to the desired position (the slice number will be shown
      in the label above the slider).

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The button is available, if at least two slides have been loaded (by
      pressing the start button before). The slider is only available
      after pressing the (activation) button.


10) === BUTTON for Colors Choice ===

   Purpose:
      For changing the animation colors and fine tuning their characteris-
      tics (to learn more about color manipulation, please read the help
      entry for the colors pop-up window).

   Type:
```

```
      Button to open a pop-up window for plot color selection and fine tuning
      of plot color characteristics.

   Format/Usage:
      Press the button to open colors pop-up window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Colors button is only available if at least two slides were loaded
      (by pressing the start button before).


11) === BUTTON for Erase ===

   Purpose:
      To completely erase the animation window.

   Type:
      Button to erase the animation window.

   Format/Usage:
      Press the button to erase the animation window.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      The erase button is available if the stop button was pressed after
      an animation session.


12) === DROPLIST for Image/Contours Choice ===

   Purpose:
      Allows to choose between two different animation color modes (the
      Image/Contours or the Contour Fill mode).

   Type:
      Droplist with different entries available for selection.

   Format/Usage:
      Click button for dropping the list, then click on desired entry.
      The droplist-button always shows the current setting.

   Range of Values:
      One of the following two values: 'Image/Contours', or 'Contour Fill'.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


13) === DROPLIST for Color Range Choice ===

   Purpose:
      Allows to choose between two different animation color range modes
      (the Colors/Slice or the Color/Volume mode). In the Color/Volume
      mode, the colors for each slide are physically compatible (the same
      data value in each slide has the same color), whereas in the Color/
      Slice mode, the full color range is used for each individual slice
      (the colors for different slices can have different meanings, i.e.
```

one slice has a data range from 0 to 1, another a range from
2 to 5 and in each case the full color range is used).

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following two values: 'Colors/Volume', or 'Colors/Slice'.

Notes on Values:

Availability/Indirect Effects:
Always available.

14) === DROPLIST for Contour Lines Color Choice ===

Purpose:
Allows to choose amongst six different contour line color settings
for data animation.

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following six values: 'Def. Contours', 'White Contours',
'Red Contours', 'Green Contours', 'Blue Contours', 'Black Contours'.

Notes on Values:

Availability/Indirect Effects:
Only available, if the contour line activation button in the
Animation Settings field was pressed.

15) === BUTTON for saving the Animation Window content as MPEG-Video ===

Purpose:
The MPEG Output... button opens a pop-up window for saving the
currently loaded animation sequence into an MPEG-Video file. The
MPEG Output file will stored in the ../../referdata/volume directory
(the default MPEG filename can be altered).

Type:
Button to open a pop-up window for MPEG Output file specification.

Format/Usage:
Press the button to open the MPEG Output pop-up window.

Range of Values:

Notes on Values:

Availability/Indirect Effects:
To MPEG Output button is only available, if a data animation sequence
is already loaded.

INPUT EXAMPLE(S)

```
- Load slices for animation:
   Press the Start button.

- Start animation backwards:
   Press the Reverse Play bitmap button.
```

6.10.6 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.10.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.10.8 Prepare Atmosphere/Ionosphere Volume Data Input

6.10.8.1 Atmosphere/Ionosphere Model and Parameter Selection

```
GENERAL DESCRIPTION

This input group allows to choose Atmosphere and Ionosphere Models and
atmospheric (ionospheric) Parameters. Six different Atmosphere Models
(Bi-Exponential-, HLat 2D-, 3D dry-, GCM 3D-, HiVRes-, and a User-
supplied Atmosphere) and two Ionosphere Models (Double-Chapman- and a
3D Ionosphere) Models are available. Selectable parameters for
Atmosphere Models are temperature, pressure, mass density, refractivity,
water vapor pressure, and specific humidity, whereas for Ionosphere
Models, electron density and ionosphere refractivity can be selected.


SPECIAL NOTES/HINTS

- The Atmosphere (Ionoshper) Parameter droplist button is only available
  in case an Atmosphere (Ionosphere) model was selected.


INPUT PARAMETER(S)

 1) === DROPLIST for Atmosphere/Ionosphere Model Choice ===

    Purpose:
       Allows to select among six different Atmosphere Models (Bi-
       Exponential-, HLat 2D-, 3D dry-, GCM 3D-, HiVRes-, and a User-
       supplied Atmosphere) and two Ionosphere Models (Double-Chapman-
       and a 3D Ionosphere).

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following eight values: 'Bi-Exponential Atm. (RefAtm_UoG)',
       'HLat 2D Atmosphere (CIRA86aQ_UoG)', '3D Atmosphere dry (MSIS90_DMI)',
       'GCM 3D Atmosphere (GCM3DAtm)...', 'HiVRes Atmosphere (HiVResAtm)...',
       'User-supplied Atm. (RefAtm_UoG)', 'Double-Chapman Ion. (RefIon_UoG)',
       '3D Ionosphere (Iono3D_UoG)'.
```

```
    Notes on Values:
       Selecting the GCM 3D or the HiVRes Atmosphere opens an extra pop-up
       window for GRIB (Raob) data file path and name input.

    Availability/Indirect Effects:
       The droplist is always available.


 2) === DROPLIST for Atmosphere/Ionosphere Parameter Choice ===

    Purpose:
       Allows to select between temperature, pressure, mass density,
       refractivity, water vapor pressure, and specific humidity in case
       of Atmosphere Parameter and electron density and ionosphere refrac-
       tivity in case of Ionosphere Parameter.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following values for Atm. Parameter: 'Temperature (Temp)',
       'Pressure (Pres)', 'Mass Density (Dens)', 'Refractivity (Refract)',
       'Water Vapor Pres. (Wvap)', 'Specific Humidity (SpHumid)'.
       One of the following two values for Ion. Parameter: 'Electron Density
       (ElDens)', 'Ion.Refract.-GPS/L1 (IonRefr)'.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The Atm. (Ion.) Parameter droplist is only available, if an Atmosphere
       (Ionosphere) Model was selected from the Atm/Ion Model droplist.


INPUT EXAMPLE(S)

- Selecting pressure as atmosphere parameter:
   Select 'Pressure (Pres)' from the Atm. Parameter droplist.
```

6.10.8.2 Atmosphere/Ionosphere Model Data Preparation Input

```
GENERAL DESCRIPTION

This input group allows to manipulate the Height, Lat- and Lon Grid,
UT, Month and, for an Ionospher Model, the Solar Activity/F107 index.


SPECIAL NOTES/HINTS

- Sol.Act./F107 is only sensitive, if an Ionosphere Model was selected.


INPUT PARAMETER(S)

 1,2,3) === DROPLISTS for Fixed Dimension Choice ===

    Purpose:
       Allows to fix 3 from the 6 underlying dimensions. The left droplist
       allows to select height, latitude, longitude, and universal time.
       The parameter list in the middle droplist depends on selection made
       in the left droplist (if height was selected, then the parameter list
       in the middle droplist is set to latitude, longitude, universal time,
       and month; if latitude was selected, then the list provides longitude,
       universal time, and month and so on). The right droplist is not
```

applicable (N/A) for an atmosphere model. For an ionosphere model, the parameters of the right droplist depend on the setting of the middle droplist (if latitude was selected, then the parameter list is set to longitude, universal time, month, and solar activity index; if longitude was selected, then the list shrinks to universal time, month, and solar activity index and so on).

Type:
Droplist with different entries available for selection.

Format/Usage:
Click button for dropping the list, then click on desired entry.
The droplist-button always shows the current setting.

Range of Values:
One of the following 4 values for the left droplist: 'Hei', 'Lat', 'Lon', 'UTi'.
One of the following 4 values for the middle droplist: 'Lat', 'Lon', 'UTi', 'Mon'.
One of the following 4 values for the right droplist: 'Lon', 'UTi', 'Mon', 'SAc'.

Notes on Values:
The actual parameter length of the middle (right) droplist depends on the setting of the left (middle) droplist.

Availability/Indirect Effects:
The droplists are always available.

4) === INPUT FIELD for Height (Grid) Choice ===

Purpose:
Allows to change the shown (default) height (grid) by keyboard input.

Type:
Text input field for input of the height (grid).

Format/Usage:
Make changes of the given height (grid) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
From 0 to 20000 km.

Notes on Values:
Only numbers with a maximum of one post comma digit and blanks to separate the different values (in case of height grid) are allowed.

Availability/Indirect Effects:
Always available.

5,6) === INPUT FIELDS for input of the Lat/Lon (Grid) Choice ===

Purpose:
Allows to change the shown (default) latitude/longitude (grid) by keyboard input.

Type:
Text input fields for input of the latitude/longitude (grid).

Format/Usage:
Make changes of the given latitude/longitude (grid) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
For latitude from -90 to 90 deg, for longitude from -180 to 180 deg.

Notes on Values:
Only numbers with a maximum of one post comma digit and blanks to separate the different values (in case of latitude/longitude grid) are allowed.

Availability/Indirect Effects:
Always available.

7) === INPUT FIELD for UT (Grid) Choice ===

Purpose:
Allows to change the shown (default) universal time (grid) by keyboard input.

Type:
Text input field for input of the universal time (grid).

Format/Usage:
Make changes of the given universal time (grid) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
From 0 to 24 hours (0 to 59 minutes).

Notes on Values:
Only numbers with a maximum of one post comma digit and blanks to separate the different numbers (in case of universal time grid) or integer numbers (in case of universal time) are allowed. Note that in case of universal time grid input the time are given in hours (with one post comma digit) whereas for normal universal time input the time format is hour and minute (hhmm).

Availability/Indirect Effects:
Always available.

8) === INPUT FIELD for Month (Grid) Choice ===

Purpose:
Allows to change the shown (default) month (grid) by keyboard input.

Type:
Text input field for input of the month (grid).

Format/Usage:
Make changes of the given month (grid) by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
From 1 to 12.

Notes on Values:
The months are numbered (1=Jan,... 12=Dec). Only integer numbers are allowed.

Availability/Indirect Effects:
Always available.

9) === INPUT FIELD for Solar Activity/F107 (Grid) Choice ===

Purpose:
Allows to change the shown (default) solar activity/F107 index (grid) by keyboard input.

Type:
Text input field for input of the solar activity index (grid).

```
    Format/Usage:
       Make changes of the given solar activity index (grid) by key-
       board input.
       Press <CR> to deliver the input to the system.

    Range of Values:
       From 75 to 220.

    Notes on Values:
       Only integer numbers are allowed.

    Availability/Indirect Effects:
       Only available, if an Ionosphere Model was chosen.
```

INPUT EXAMPLE(S)

- Select March as valid month:
  Set the Month input field to '3'.

6.10.8.3 Compute

GENERAL DESCRIPTION

Pressing the 'Compute' button causes EGOPS to start the numerical calculation by employing the corresponding software package (in this case written in IDL). It performs 3D atmosphere/ionosphere model data computations based on the current input and produces the necessary result file for the subsequent visualization. (To learn more about the file structure behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level Help menu.) The name of the resulting atmosphere/ionosphere maps data file will be shown in the input field below the compute button. It is not possible to change the predefined resulting atm/ion maps data file name. After starting a computation, an 'Information Window' pops up with a short hint that EGOPS started atm/ion model data computing. When the calculation is finished, the 'Information Window' will be closed.

SPECIAL NOTES/HINTS

- Be careful in selecting your simulation input parameters in order not to waste computation time and disk space for results not really exploited. Note that some input combinations (very long simulation time ranges etc.) can result in very long computation times.

INPUT PARAMETER(S)

```
 1) === BUTTON for Compute ===

    Purpose:
       Causes EGOPS to start the numerical calculation by employing the
       corresponding software package. It performs 3D atmosphere/ionosphere
       model data computations based on the current input and produce the
       necessary result file for the subsequent visualization.

    Type:
       Button

    Format/Usage:
       Click button to start computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
```

```
       The button is always available.
       If a needed file is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user) the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Thus, after the
       correction of a problem "behind the scene", you can proceed as usual.
       (To learn more about Error Handling related to EGOPS, consult the
       appropriate sections of the User Manual.)


 2) === INPUT FIELD for showing the Resulting Atm/Ion Maps Data Filename ===

    Purpose:
       Shows the predefined resulting atmosphere/ionosphere maps data
       filename.

    Type:
       Input field (non editable).

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The input field is always available.


INPUT EXAMPLE(S)

- Command Compute:
   Press the 'Compute' button and let your machine work (dependent on your
   task you may have some time for other work now...)
```

6.10.8.4 Batch...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.1, titled "Batch..." .

6.10.8.5 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.10.8.6 Batch Info...

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.2, titled "Batch Info..." .

6.10.8.7 Reset Defaults

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.2.1, titled "Reset Defaults" .

6.10.9 Batch Job Input

6.10.9.1 Start Time

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.3, titled "Start Time" .

6.10.9.2 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.10.9.3 Jobs

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.4, titled "Batch Jobs" .

6.10.10 Batch Processing Information

6.10.10.1 Quit

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.2, titled "Quit" .

6.10.10.2 Refresh

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.6, titled "Refresh" .

6.10.10.3 Terminate Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.7, titled "Terminate Task" .

6.10.10.4 Restart Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.8, titled "Restart Task" .

6.10.10.5 Remove Task

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.9, titled "Remove Task" .

6.10.10.6 Remove finished Tasks

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.4.10, titled "Remove finished Tasks" .

6.10.11 Colors Input

6.10.11.1 Color Tables

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.1, titled "Color Tables" .

6.10.11.2 Color Options

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.2, titled "Color Options" .

6.10.11.3 Color Function

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.10.3, titled "Color Functions" .

6.10.11.4 OK

The information on this topic is provided in the chapter on "Common Dialogs" - Section 8.1.1, titled "OK" .

6.10.12 MPEG Output Input

6.10.12.1 MPEG Output

```
GENERAL DESCRIPTION

The MPEG Output Pop-up Widget is the graphical user interface for
storing the actual animation window content as MPEG-Video file. The
Pop-up Widget shows the MPEG Output file path and allows to manipulate
the MPEG Output Filename for storing of the animation data sequence.
The resulting output MPEG-Video is written to directory
../../referdata/volumdata.


SPECIAL NOTES/HINTS

- MPEG outputs are only supported, if a special MPEG feature license is
  available on your computer (the MPEG output license is not included in
  the standard IDL-license package). For more information, please contact
  your Research Systems, Inc. sales representative or technical support.
- It is not possible to manually change the file path for the MPEG output file.


INPUT PARAMETER(S)

 1) === INPUT FIELD for showing or changing the MPEG Output Filename ===

    Purpose:
       Allows to change the default MPEG Output Filename.
```

Type:
Editable Text input field for showing and changing the MPEG Output Filename.

Format/Usage:
Make the necessary changes of the MPEG Filename by keyboard input.
Press <CR> to deliver the input to the system.

Range of Values:
All alphanumeric strings with a maximum of 30 characters.

Notes on Values:

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Change MPEG Output Filename:
  Make changes of the default MPEG Output Filename by keyboard input.

7 Help Menu

7.1 Help on Project

7.1.1 About Projects

```
GENERAL DESCRIPTION

EGOPS work and related data are organized in "projects", providing the user
with a convenient means to group the computations of a series of simulation
scenarios, which for some logical reason belong to each other, into a common
folder. A "Project" within EGOPS is thus a group of simulation and
visualization/validation activities whose data (input/output of simulation
scenarios) is separated from that of other projects.

Each project is named by a user-specified project identification, called
"Project-id", which is a 25 character name to be assigned when a new project
is launched, employing the "Launch new..." function.

In fact, the separation of the projects is physically reflected in the
EGOPS file structure on disk, where each project's data are gathered below
a /<project-id> subdirectory, which is created as subdirectory of the
root directory /EGOPS during project launch.

There is one project that is integral to EGOPS, named "EGOPSProject".
It belongs to the basic installation package. This is the default
project of EGOPS which contains the minimal default information necessary
to operate the simulation and visualization/validation functionality.
(Each time a new project is started, this minimal default information
is carried over from the "EGOPSProject" to the new project's directories.)

For allowing to better comprehend the example given below of what an EGOPS
project could comprise, we note that the individual computational scenarios
themselves gathered in a project are called "tasks" within EGOPS. A task
corresponds to computing a specific simulation scenario (sequence of
operations) by employing one of the four generic Task options accessible via
the "Task" menu of the User Interface. These generic Task options are Mission
Analysis/Planning (MAnPl), Forward Modeling (FoMod), Observation System
Modeling (OSMod), and Occultation Data Inversion/Retrieval (InRet).
[More information on tasks is found under "Help - Help on Task"]


SPECIAL NOTES/HINTS

- Though it were possible, it is good practice not do start working
  directly under the default project "EGOPSProject". This avoids to
  accumulate miscellaneous tasks there which do not really comprise a
  meaningful logical group.
  It is better to first select "Launch new..." in the project menu and create
  a new project each time you start with a fresh series of tasks constituting
  a new "study".


EXAMPLE

A "project" could be:

  "METOP-1/GRAS temperature retrieval accuracies for different inversion
  techniques", for which we might assign the Project-id
  "M1GRAS-TretrievStudy1".

Individual "tasks" which this "project" could comprise (as arbitrary examples):

1. "Prepare a good sample of METOP occultation events for the accuracy
```

assessment" (meaning a few "tasks" employing the Task option MAnPl)

2. "Simulate occultation data for the sample of events using a reasonable representation of the atmosphere/ionosphere" (employing the Task option FoMod)

3. "Account for the effects imposed on the signals by the observation system (GRAS receiver + antenna, etc.)" (employing the Task option OSMod)

4. "Use these simulated METOP reference data with some selected inversion/retrieval processing chain down to temperature profiles" (different chains used, each an individual "task", based on the tools available within Task option InRet)

The output data for the temperature from the different chains could then be statistically analyzed and intercompared by employing the visualization/validation functionality of EGOPS.

7.1.2 Launch New

GENERAL DESCRIPTION

EGOPS work and related data are organized in "projects", providing the user with a convenient means to group the computations of a series of simulation scenarios (which, for some logical reason, belong to each other) into a common folder. A "Project" within EGOPS is thus a group of simulation and visualization/validation activities, whose data (input/output of simulation scenarios) is separated from that of other projects.

For creation of a new EGOPS Project, assign it a unique, not yet existing identifier. The length of this "Project-id" of the new EGOPS Project is limited to a maximum of 25 characters (minimum length is one char). The new EGOPS/Project-id should be an arbitrary alphanumeric string which may also contain hyphen or underline characters. Longer strings, inter-leaved blanks, or use of other characters are not allowed.

LAUNCH NEW EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows two different kinds of input for launch new EGOPS project.

- EGOPS/Project-id:
This text input field allows the assignment of a new EGOPS/Project-id by keyboard input. Each new project should be named by a user-specified project identification, called "Project-id", which is limited to a maximum 25 character name to be assigned when a new project is launched, employing the "Launch new..." function.

- Edit <project-id>.log...:
Opens a text input field, to which the user can make his own notices about the new EGOPS-Project (the content of this log-file can always be modified every time this newly created EGOPS-Project will be closed or opened if necessary).

7.1.3 Open

GENERAL DESCRIPTION

Most of the EGOPS functionality can only be used by working within an open EGOPS-Project (part of the 5 main EGOPS visualization/validation tools are also allowing some limited use of EGOPS without being inside an open project). To use the full capabilities of EGOPS, one has to enter (open) an existing EGOPS-Project (or to create a new one with the EGOPS launch new tool). Therefore, the open EGOPS project window allows for selecting and opening of an already existing EGOPS/Project-id. Selection of a project-id can be made directly by typing the EGOPS/Project-id name into the foreseen input field or by means of the button/select-list window ("Existing EGOPS/Project-ids..." button).

OPEN EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows several different kinds of input for open EGOPS project.

- EGOPS/Project-id:
This text input field allows the assignment of an already existing EGOPS/Project-id by keyboard input. It's not allowed to assign a new EGOPS Project-id by direct keyboard input (use the "Project - Launch new..." function for this purpose.)

- Existing EGOPS/Project-ids...:
This button/select-list window allows to select an existing EGOPS/Project-id out of all existing ones shown in the list.

- Edit <project-id>.log...:
Opens a text input field to which the user can make his own notices about the EGOPS-Project foreseen for opening (the content of this log-file can always be modified every time this EGOPS-Project will be closed or re-opened if necessary).

7.1.4 Close

GENERAL DESCRIPTION

With EGOPS, only one special EGOPS Project can be open at a time, therefore the user is forced to close the currently open EGOPS project, if he wants to work with another or exits EGOPS. For this purpose, an extra window for closing the currently open EGOPS project is available. Only the currently open EGOPS Project can be closed. If the user wants to close the currently open EGOPS project and then plans to exit EGOPS completely, it is not necessary to close the open EGOPS project manually with Close EGOPS Project and Exit EGOPS afterwards, because activating EGOPS Exit will do both actions in line (without opening the Close EGOPS Project pop-up window). The only difference between Close-Exit and Exit is that in the latter case it is not possible to make any inputs to the corresponding EGOPS project.log file.

CLOSE EGOPS PROJECT INPUT PARAMETER(S)

EGOPS offers only one text input for close EGOPS project.

- Edit <project-id>.log...:
This opens a text input field to which the user can make his own notices about the currently EGOPS-Project prepared for closing (the content of this log-file can always be modified every time this EGOPS-Project will be re-opened or closed again, if necessary).

7.1.5 Rename

GENERAL DESCRIPTION

Sometimes, while doing a lot of work within one EGOPS project, the user may come to the point, finding the name of this special project not reflecting the content or spirit of his work anymore. Therefore, EGOPS offers the possibility of renaming the EGOPS project identification without changing or losing anything of the contents of the different tasks already worked out under the former project name. For this purpose, an EGOPS pop-up window for renaming an already existing (old) EGOPS/Project-id to a (new) EGOPS/Project-id is provided. Selecting the existing (old) EGOPS/Project-id can be done by directly typing the old EGOPS/Project-id name into the foreseen input field or by means of the button/select-list window ("Existing EGOPS/Project-ids..." button). The new EGOPS/Project-id need be put in by keyboard into the right input field. The standard format conventions for EGOPS/Project-id strings of course apply also to new EGOPS/Project-ids assigned here (cf. help on "Launch new..."). There is also the possibility foreseen that the user may want to modify the renamed EGOPS project.log file afterward. The "old" Project-id is renamed to the new one everywhere in the project-related file structure (project directory name, Project-id entries in the existing task input files, etc.), with one exception: the name is not changed within the input file location info string in the headers of the "old" task's output data files.

RENAME EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows several different kinds of input for rename EGOPS project.

- Old EGOPS/Project-id:
This text input field allows the assignment of an already existing EGOPS/Project-id by keyboard input. It's not allowed to assign a new EGOPS Project-id by direct keyboard input (use the "Project - Launch new..." function for this purpose). If an EGOPS Project is currently open, its (old) EGOPS/Project-id is shown by default in the left input field.

- New EGOPS/Project-id:
This text input field allows the assignment of a new EGOPS/Project-id name by keyboard input. Be careful to use a new EGOPS project-id name that is really a new one and does not interfere with an existing one.
The EGOPS/Project-id string is limited to a maximum of 25 characters name.

- Existing User-defined EGOPS/Project-ids...:
This button/select-list window allows to select an existing EGOPS/Project-id out of all existing ones shown in the list for renaming.

- Edit <new-project-id>.log...:
Opens a text input field to which the user can make his own notices about the EGOPS-Project foreseen for renaming (the content of this log-file can always be modified every time this EGOPS-Project will be opened or closed if necessary).

7.1.6 Delete

GENERAL DESCRIPTION

Old EGOPS projects or EGOPS projects with no useful content (i.e. test projects) should be removed from EGOPS completely from time to time to save disk space. This can be done by using the window for deleting an already existing EGOPS Project. Deleting can be done by directly typing the EGOPS/Project-id name into the foreseen input field or by means of the button/select-list window ("Existing EGOPS/Project-ids..." button). But be careful in using this function, since deletion of a project means that all information (input/output data of all simulations performed within the project) including the project's directory structure is cleared from the disk forever!

DELETE AN EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows only one input for delete an EGOPS project.

- The EGOPS/Project-id to be deleted:
This text input field allows the assignment of an already existing EGOPS/Project-id by keyboard input for deleting. If an EGOPS Project is currently open, its EGOPS/Project-id is shown by default in the input field. Trying to choose a non-existing EGOPS Project by direct keyboard input is inappropriate (and leads to an error message). Also, the EGOPS-internal basic or reference project "EGOPSProject" is protected from deletion (attempts lead to an error message).

- Existing User-defined EGOPS/Project-ids...
This button/select-list window allows to select an existing EGOPS/Project-id out of all existing ones shown in the list for deleting.

7.1.7 Shelve

GENERAL DESCRIPTION

Most of the EGOPS functionality can only be used by working within an EGOPS-Project (part of the 5 main EGOPS visualization/validation tools are also allowing some limited use of EGOPS without being inside an open project). The file content (in term of used disk space) of a project can be very substantial especially if a lot of PS-files were produced or if the project contains a great number of "big" individual tasks. For finished projects or for projects which are not needed in the near term future for further processing, EGOPS offers an elegant way to compress and store those projects for later (re)use. Therefore, to save disk space, the shelve EGOPS project window provides facilities for selecting and archiving of an already existing EGOPS/Project-id. Selecting of a project-id can be done directly by typing the EGOPS/Project-id name into the foreseen input field or by means of the button/select-list window ("Existing EGOPS/Project-ids..." button).

SHELVE EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows several different kinds of input for shelve EGOPS project.

- EGOPS/Project-id:
This text input field allows the assignment of an already existing EGOPS/ Project-id by keyboard input (for obvious reasons it's not allowed to assign a new EGOPS Project-id by direct keyboard input).

- Existing EGOPS/Project-ids...:
This button/select-list window allows to select an existing EGOPS/Project-id out of all existing ones shown in the list.

- Edit <project-id>.log...:
Opens a text input field to which the user can make his own notices about the EGOPS-Project foreseen for archiving (the content of this log-file can always be modified later again (after restoring the shelved EGOPS-Project) every time this EGOPS-Project will be closed or re-opened if necessary).

7.1.8 Restore

GENERAL DESCRIPTION

A shelved EGOPS project can very easyly be restored for later reworking on it within EGOPS by using the window for restoring an already existing archived EGOPS Project. Restoring can be done by directly typing the shelved EGOPS/Project-id name into the foreseen input field or by means of the button/select-list window ("Existing User-defined EGOPS/Project-ids..." button).

RESTORE AN EGOPS PROJECT INPUT PARAMETER(S)

EGOPS allows only one input for restore an EGOPS project.

- The EGOPS/Project-id which shall be restored:
This text input field allows the assignment of an already existing shelved EGOPS/Project-id by keyboard input for restoring. If an EGOPS Project with the same name is already existing, a warning will pop-up (an information will be displayed about the possibilities to handle this situation). Trying to choose a non-existing EGOPS Project by direct keyboard input is inappropriate (and leads to an error message).

- Existing User-defined EGOPS/Project-ids...
This button/select-list window allows to select an existing EGOPS/Project-id out of all existing ones shown in the list for restoring.

7.1.9 BatchJobs Info

GENERAL DESCRIPTION

EGOPS Batch Processing Information window provides information on the on EGOPS batch job status. For all EGOPS batch jobs, the Job-Id, the Project- and Task-Id, Start Time, Status, and the PID number are displayed. Besides the display of batch job information, a facility for manipulation of batch jobs is provided, e.g. it is possible to terminate a running task, to restart a task, or to remove finished tasks from the job list.

POSSIBLE EGOPS BATCH PROCESSING INFORMATION WINDOW CONTENT ACTION(S)

EGOPS allows several actions to be performed on the contents of the batch processing window, namely:

- Refresh:
Three different refresh modes for actualizing the EGOPS batch processing information list are available.

- Terminate Task:
Currently running EGOPS batch jobs can be terminated by first marking the job in the list with the left mouse button and then activating the terminate task button.

- Restart Task:
Job restart allows to reexecute a formerly failed EGOPS batch job (job status error). Before pressing the restart task button, the corresponding EGOPS job has to be marked with the left mouse button.

- Remove Task:
This allows to remove finished EGOPS batch jobs from the information list (the job(s) must be marked with the left mouse button, before the remove task button can be activated).

7.2 Help on Task

7.2.1 About Tasks

GENERAL DESCRIPTION

The individual computational scenarios in an EGOPS Project [cf. "Help on Project - About Projects"] are called "tasks". A task corresponds to computing a specific scenario (or, in other words, a defined sequence of operations) by employing one of the four generic Task options accessible via the "Task" menu of the User Interface.
These generic Task options are Mission Analysis/Planning (MAnPl), Forward Modeling (FoMod), Observation System Modeling (OSMod), and Occultation Data Inversion/Retrieval (InRet).
Within the EGOPS directory structure there exists, for each Project, one subdirectory for each of these generic Task options (i.e., there exist /MAnPl, /FoMod, /OSMod, /InRet subdirectories under each /<Project-id> directory).

Each task is named by a User-specified task identification, called "Task-id", which is a 25 character name to be assigned when a new task is prepared within the pop-up window of one of the generic Task options of the "Task" menu (e.g., within the "Mission Analysis/Planning Input" pop-up window).

The Task-id is the key identification means for EGOPS to separate all files relating to a specific task from those of other tasks with usually different inputs (which will have assigned a different Task-id). In fact all files relating to a specific task will contain the Task-id as leading part of the filename. The files will be saved under the subdirectory of the generic Task option under which the task was created (e.g., in the /MAnPl subdirectory in case of a MAnPl Task).

SPECIAL NOTES/HINTS

- Assign your task a "smart" Task-id which conveys some hint to you on what this task is about. See it like choosing a good brief title for your task. Among other things, this is very helpful during the visualization/validation of your results, where your primary selector for loading result data for visual inspection and analysis will be the Task-id.

7.2.2 Mission Analysis/Planning

GENERAL DESCRIPTION

Mission Analysis/Planning (MAnPl) is considered to include the analysis and planning of single LEO satellites and LEO constellations carrying GNSS occultation receivers, including antennae field-of-view planning and analysis and visibility analysis w.r.t. ground stations, for assess-ing, investigating, and optimizing occultation event coverage and related relevant statistics. Further included are reflection data calculation scenarios whereas the reflection geometry GNSS satellite - water surface (normally the ocean or several huge lakes) as big mirror for reflecting the GNSS radio signals to the LEO - LEO satellite can be analyzed.

Such analysis requires a considerable number of "free input parameters" in a simulation tool in order to allow for a (realistic) MAnPl simulation of widely arbitrary GNSS occultation missions. (See the section "MAnPl INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "MAnPl Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "MAnPl VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize MAnPl Statistics, Help on Visualize Geographic Maps" entries of the "Help" menu. Details are found in the On-line Help within the "Visualize Mission Analysis/Planning Statistics" and "Visualize Geographic Maps" interface windows available via the "Visualize/Validate" menu.)

MAnPl INPUT PARAMETERS

EGOPS allows to compute Mission Analysis/Planning tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Mission Analysis/Planning. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific MAnPl task.

The "MAnPl Input" window, available via the "Mission Analysis/Planning" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a few input file names, providing for access to some more lengthy parameter lists required, e.g., satellite orbit elements).

- Data type:
The selection between occultation- and reflection data is possible.

- Simulation time:
Start date and time, and the total time range for a simulation.

- Height levels of interest:

For each of such height levels (and for each occultation in the time range) the corresponding occultation geometry is computed, interpreting the height levels as those tangent point heights of an occultation event for which the geometric information is sought just at the instant when the levels are crossed. The essential geometric information is the corresponding geographic coordinates of the tangent point together with the corresponding positions of the GNSS and LEO satellites involved in the occultation event. Height levels are only used for calculation of occultation data.

- Time step:
Choose an integer divide of the simulation time range for the reflection data time step. Time steps are only used for reflection data calculation.

- Geographic area of interest:
Global, hemispheric, or any regional area for which the coverage by occultation events is sought.

- GNSS-LEO/Reflection ray treatment:
Straight-line approximation of rays, or rays with quasi-realistic bending caused by the neutral atmosphere.

- Earth Figure model:
Spherical (R = 6371 km) or Ellipsoidal (WGS-84) Earth.

- Occultation/Reflection antennae specifications:
Antennae pointing and characteristics, including boresight direction and field-of-view width and shape, for "anti-velocity" looking and forward-looking antenna.

- Spaceborne receiver segment (LEO satellites):
Number and orbit constellation (i.e., orbit elements) of receiver platforms in LEO, and information on the LEO's zenith-antenna field-of-view.
This information is supplied by the leo*.tle files in the /orbitelem directory, one of which is always selected within the "MAnPl Input" window.
[Read the tle.Help file in the /orbitelem directory for more information on how to supply this information for LEOs.]

- LEO orbit propagator:
Spherical orbit approximation, Keplerian orbit, or "Simplified General Perturbation (SGP)" orbit (the latter including short and long period perturbations and parameterized atmospheric drag).

- Active space segment (GNSS):
Number and orbit constellation (i.e., orbit elements) of the GNSS transmitters.
Either GPS or GLONASS or both these GNSS systems are available for selection.
This information is supplied by the gps*.tle and glo*.tle files in the /orbitelem directory of EGOPS, which are selected within the "MAnPl Input" window.
[Read the tle.Help file in the /orbitelem directory for more information on how to supply this information for the GNSS.]

- GNSS orbit propagator:
Spherical orbit approximation, Keplerian orbit, or "Simplified General Perturbation (SGP)" orbit (the latter including short and long period perturbations and parameterized radiation/star drag).

- Ground segment (Fiducial and Tracking sites):
The number, location, and antenna field-of-view of auxiliary GNSS receiver sites for aiding the usual single- or double-difference processing of occultation data (fiducial sites), and the number, location, and antenna field-of-view of ground stations for telemetry/telecommand (tracking sites).
This information is supplied by fid*.gst and trk*.gst files, respectively, in the /groundst directory of EGOPS, which are selected within the "MAnPl input" window. [Read the gst.Help file in the /groundst directory for more information on how to supply this information on the sites.]
Satellite visibility information is then computed for the fiducial and tracking stations, as necessary for assessing the visibility conditions for single- and/or double-differencing and tracking for a given scenario.

MAnPl VISUALIZATION

EGOPS provides for the visualization of results of Mission Analysis/Planning tasks by its "Visualize MAnPl Statistics" and "Visualize Geographic Maps" window interfaces, both available through the "Visualize/Validate" menu.

The "MAnpl Statistics" interface allows to compute, visualize, and print-out 1D and 2D occultation coverage statistics as function of variables like latitude, Local Time, Duration of occultation Events, etc.
Furthermore, it allows to compute, visualize, and print-out visibility statistics for fiducial and tracking sites, e.g., no. of occultation events for which successful single- or double-differencing is possible by each of a given sample of fiducial sites, or no. of orbits seen for a certain time range per orbit by each of a couple of tracking sites.
[See "Help on Visualize/Val. - Help on Visualize MAnPl Statistics" for more information.]

The "Geographic Maps" interface allows to compute, visualize, and print-out latitude-longitude maps (different map projections available) of occultation event coverage for arbitrary geographic areas and including information such as on the geometrical shape and time of each event.
Furthermore, it allows to compute, visualize (stand-alone or as overplot to occultation event coverage maps), and print-out geographic maps of a series of atmospheric/ionospheric variables (e.g., temperature and electron density) from all atmospheric/ionospheric models available within EGOPS. These may either slice the atmospheric/ionospheric field at a certain height or be vertically integrated quantities (e.g., total precipitable water).
[See "Help on Visualize/Val. - Help on Visualize Geographic Maps" for more information.]

7.2.3 Forward Modeling

GENERAL DESCRIPTION

Forward Modeling (FoMod), together with subsequent Observation System Modeling (OSMod), performs quasi-realistic simulation of observables, and related required variables, of the GNSS occultation technique. The main observables are time-tagged phase and amplitude measurements, obtained in real world by tracking occulted GNSS signals with a LEO platform-mounted GNSS receiver for atmospheric sounding (GRAS) during their set/rise through the atmosphere imposed by the relative orbital motion of the GNSS and LEO satellites.

Forward Modeling itself denotes the simulation of GNSS signal propagation through the atmosphere/ionosphere system given the orbital motions of the GNSS and LEO satellites. It results in "ideal" signals which contain the effects of the atmosphere/ionosphere media only. - "Ideal" in the sense that it is the state of the signal right before it enters the receiving antenna and before any degradations by the receiving system are incurred. Thus FoMod results allow to inspect the environmental influence alone.
In addition to spaceborne radio occultations (GNSS-LEO) EGOPS allows also to simulate airborne occultations (GNSS-Airplane) where the GRAS receiver is placed onboard an aircraft instead of a LEO satellite.

Furthermore, it is quite useful in terms of computational performance to separate FoMod, involving CPU-expensive propagation simulation (i.e., ray tracing) from OSMod, since the latter can be treated very efficiently as superposition of "observation system" effects on the "ideal" signal. Thus studies of different receiving system effects can be efficiently carried out using one and the same CPU-expensive FoMod results as baseline. [See "Help on Task - Help on Observation System Modeling" for more information on OSMod.]

In case of interest in observation simulations, Forward Modeling is the natural stage in EGOPS following some planning and preparation of occultation events with desired properties within "Mission Analysis/Planning (MAnPl)" (e.g., events occurring in a geographic region of interest, etc.). In fact the geometric properties (i.e., LEO and GNSS orbital arcs) of an occultation event being "forward modeled" can be, in case simulations are desired for realistic geometry, directly taken from the results of a User-selected MAnPl task (typically prepared before). For a realistic airborne occultation the mission analysis and planning part will be additionally done together with the rest of the pure forward modelling tasks in FoMod.

Such forward modelling requires a considerable number of "free input parameters" in a simulation tool in order to allow for a (realistic) FoMod simulation of widely arbitrary GNSS occultation missions. (See the section "FoMod INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "FoMod Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and validation of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "FoMod VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize/Val. Profiles" entry of the "Help" menu. Details are found in the On-line Help within the "Visualize/Validate Profiles" interface window available via the "Visualize/Validate" menu.)

FoMod INPUT PARAMETERS

EGOPS allows to compute Forward Modeling tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Forward Modeling. Nomen est omen all these parameters can be - within their range of validity - freely set by the User just as desired for a specific FoMod task.
The "FoMod Input" window, available via the "Forward Modeling" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a "Reference MAnPl Task-id" in case simulations are desired for realistic geometry, providing for access to the input conditions and results of a prior MAnPl task).

- Type of occultation event to be simulated:
For spaceborne radio occultations a single event or a whole sample of events can be "forward modeled", whereby single events can be simulated either for an ideal geometry (assuming co-planar GNSS and LEO orbits and, correspondingly, virtually-vertical tangent point trajectory) or for a realistic geometry (based on the geometry data obtained for a result event of a prior MAnPl task). Sample-of-event simulations always require event samples from a prior MAnPl task. Approximately the same is true for airborne radio occultations (only sample of realistic airborne occultation events cannot be processed).

   - Specifications for modelling a single event with ideal geometry:
   Tangent point location, azimuth of occultation plane (containing GNSS, LEO, and the Earth's center), start date and time, GNSS and LEO orbital heights, and height range over which the occultation event shall be "forward modeled". In case of an ideal geometry airborne occultation all LEO specs are substituted by their corresponding aircraft specs (additionally also the speed of the airplane is needed as input parameter).

   - Specifications for modeling with realistic geometry:
   Reference MAnPl Task-id (to be selected from the list of suitable MAnPl tasks existing within the current Project), event number of desired event within the MAnPl results (if single event) or event number range within the MAnPl results (if sample of events), and height range over which the event(s) shall be "forward modeled". In case of an airborne occultation with realistic geometry the coordinates of the start and end location, the GNSS orbit element file, the start date and time, the airplane height and speed, the occultation event height range and the occultation event number are the key input parameters.

- Choice of atmospheric and ionospheric models:

- Climatological atmospheric model: No atmosphere, or simple dry or moist (bi-)exponential atmosphere, or dry 3D atmosphere, or dry or moist 2D atmosphere, or the GSM 3D Atmosphere, or the HiVRes Atmosphere, or a user-supplied atmosphere (default for the latter: the bi-exponential atmosphere). [If you have a source code version of EGOPS read the file usratm.SampleFile in the /prog/FORprog subdirectory of EGOPS in case you want to learn more about how to supply your own user-supplied atmosphere.]

- Atmospheric disturbance model: No disturbance, or gravity wave superposed, or frontal system gradient superposed, or tropopause fold superposed, or atmospheric inversion superposed.

- Climatological ionospheric model: No ionosphere, or simple double-Chapman ionosphere, or full 3D ionosphere.

- Ionospheric disturbance model: No disturbance, or traveling ionospheric disturbance (TID) superposed, or ionos. gradient superposed, or ionos. trough superposed, or ionos. storm effect superposed.

- Sampling rates for forward modeling:
500 Hz, or 250 Hz, or 100 Hz, or 50 Hz, or 25 Hz, or 10 Hz, or 5 Hz, or 1 Hz, or 0.1 Hz for the L1 frequency (if the upper limit of the occultation event height is larger than 90 km the L1 sampling rates are limited to a maximum of 50 Hz, for airborne occultations the maximum L1 sampling rate is only 5 Hz) and, for the L2 frequency, one rate of the above which is equally high or lower than the L1 rate. In case of modeling a sample of events including GPS and GLONASS events, the L2 rate for GLONASS can be set to a different rate than L2/GPS.

- Signal propagation simulator:
Quasi-3D ray tracing (considering, in terms of refractivity gradients, the radial gradient only), full-3D ray tracing (accounting for the full-3D refractivity gradient field), or wave optics propagator (for a more realistic computation dealing with diffraction and multipath effects). Accuracy of ray-tracing from GNSS to LEO can be set to be <~ 1 mm, or <~ 1 cm, or <~ 10 cm (less demanding accuracy allowing faster computations but yielding more inaccurate simulated phase observables) for the first two signal propagation simulators whereas the ray tracer accuracy for the wave optics propagator can be set to be 'High', 'Medium', or 'Low'.

FoMod VISUALIZATION

EGOPS provides for the visualization of results of Forward Modeling tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for FoMod tasks, to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "atmospheric(/ionospheric) excess phase" and "atmospheric(/ionospheric) power loss") as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different FoMod tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

7.2.4 Observation System Modeling

GENERAL DESCRIPTION

Observation System Modeling (OSMod), together with prior Forward Modeling (FoMod), performs quasi-realistic simulation of observables, and related required variables, of the GNSS occultation technique. The main observables are time-tagged phase and amplitude measurements, obtained in real world by tracking occulted GNSS signals with a LEO platform-mounted GNSS receiver for atmospheric sounding (GRAS) during their set/rise through the atmosphere imposed by the relative orbital motion of the GNSS and LEO satellites.

Observation System Modeling itself denotes the superposition of all sorts of relevant physical and technical influences of the observation system (antenna, receiver, platform, fiducial sites) on the "ideal" signal (phase and amplitude data) arriving at the receiving antenna, and on the "ideal" orbit data (GNSS and LEO positions and velocities).
In fact these "ideal" data are the output of Forward Modeling, a necessary prerequisite to be performed before Observation System Modeling can be done. [See "Help on Task - Help on Forward Modeling" for more information on FoMod.]

Many of the effects of the observation system correspond to the "classical" sort of instrumental errors (e.g., receiver noise), others are intrinsic natural parts of the receiving system (e.g., effect of the antenna gain pattern on the signal amplitude finally available). The most relevant observation system effects to be modeled include precise orbit determination (POD) errors, the antennae gain pattern, receiver noise, local multipath (due to the platform structure in the vicinity of the antenna), and differencing treatment/clocks precision. For the Realistic Receiving System Simulator (RRSS), e.g., it is now possible to include Open-Loop (OL) tracking.

Observation system modeling requires a considerable number of "free input parameters" in a simulation tool in order to allow for a (realistic) OSMod simulation of widely arbitrary GNSS occultation missions. (See the section "OSMod INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "OSMod Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and validation of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "OSMod VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize/Val. Profiles" entry of the "Help" menu. Details are found in the On-line Help within the "Visualize/Validate Profiles" interface window available via the "Visualize/Validate" menu.)

OSMod INPUT PARAMETERS

EGOPS allows to compute Observation System Modeling tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Observation System Modeling. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific OSMod task.

The "OSMod Input" window, available via the "Observation System Modeling" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including the supply of a "Reference FoMod Task-id", providing for access to the input conditions and results of a prior FoMod task).

- Forward modeling occultation event(s) selection:
The Reference FoMod Task-id can be selected from the list of suitable FoMod tasks existing within the current Project. Also, in case a sample of events is available for the selected Reference FoMod task, the event number range (or individual event number) of desired event(s) within the available FoMod

events are selectable.

- Receiver sampling rates:
Defaults are the FoMod sampling rates for the L1 and L2 frequency (one of 500 Hz, 250 Hz, 100 Hz, 50 Hz, 25 Hz, 10 Hz, 5 Hz, 1 Hz, 0.1 Hz; with L2 rate less equal L1 rate). A task with sampling rate greater than 50 Hz will not be available in the Inversion Retrieval (InRet) System later. For the Parameterized Receiving System Simulator the receiver's L1 rate needs be less or equal the FoMod L1 rate, and the receiver's L2 rate needs, in turn, be less or equal the receiver's L1 rate (For the Realistic Receiving System Simulator L1 must be equal L2 and the minimum sampling frequency is 10 Hz).

- Transmitter signal powers:
For transmitter signal powers, the L1-C/A and L2-P value can be adjusted (for a single reference FoMod task only the GPS or the GLON text input field will be active - depends on the chosen occultation - whereas for a sample reference FoMod task with GPS and GLONASS occultation events both input fields are active simultaneously).

- POD error modeling:
No POD errors, or use of a "kinematic" POD error model is provided. (The latter model mimics POD position errors mainly by considering radial GNSS and LEO position errors, POD velocity errors by considering along-ray velocity bias and drift errors (superposed to the "ideal" LEO velocity), and POD-induced excess phase errors by considering along-ray excess phase drift and acceleration errors incurred by along-ray velocity bias and drift errors.)

- Receiving system simulator type:
Between a parameterized- or a realistic receiving system simulator can be selected, with the following specifications (first for the parameterized- and second for realistic receiving system simulator):

For the parameterized receiver system simulator:

- Occultation antennae specifications:
  Antennae pointing and pattern characteristics, including boresight direction, field-of-view width and shape, and antenna gain at boresight (at GPS/L1 frequency), for "anti-velocity" looking and forward-looking antenna. The availability of a specific one of the antennae or of both depends on the type of occultation event(s) baselined via the selection of the Reference FoMod task (e.g., if a singe setting occultation event was baselined, only the "anti-velocity" antenna will be available).

- Receiver performance/noise modeling specifications:
  No receiver noise, or Gaussian noise, or realistic performance/noise can be selected, with the following specifications of the latter two:

  - Gaussian noise model:
    RMS (root-mean-square) value of the Gaussian phase noise (thermal noise).

  - Realistic performance/noise model:
    Loop bandwidth (single-sided), LEO antennae noise temperature, and the number of quantization levels in A/D conversion.

- Local multipath modeling specifications:
  No local multipath, or sinusoidal local multipath, or multiple sines, or realistic local multipath can be selected, with the following specifications of the latter three:

  - Sinusoidal multipath model:
    Period of the phase error, amplitude of the phase error, and (initialization) amplitude of the phase error at the topmost height of the occultation event.

  - Multiple sines model:
    The same specifications as of the sinusoidal multipath model, but up to 4 individual sines can be chosen for calculation.

  - Realistic multipath model:
    Ratio of multipath signal to direct signal, and source location (i.e., reflection point) of the multipath signal in (spherical)

antenna coordinates.

- Differencing treatment and clocks modeling specifications:
No differencing/perfect clocks, or no differencing/real clocks, or double differencing, or ground-based single differencing, or spacebased single differencing, with the following specifications of the latter four:

  - No differencing/real clocks:
  Relative stability of GNSS clock (assumed for the worst clock in case of no differencing with real clocks involved).

  - Double differencing:
  Relative stability of ground clock (assumed for the worst clock in case of double differencing), and atmospheric noise per ground-to-satellite link involved in the differencing (this noise considered as clock-like noise).

  - Ground-based single differencing:
  Relative stability of LEO clock (assumed for the worst clock in case of ground-based single differencing), and atmospheric noise per ground-to-satellite link involved in the differencing.

  - Space-based single differencing:
  Relative stability of LEO clock (assumed for the worst clock in case of space-based single differencing).

For the realistic receiving system simulator:

- GRAS antenna specifications - antenna pattern files:
The select button allows to choose between two different antenna pattern files. These antenna pattern characteristic files are valid for the "anti-velocity" looking antenna (only setting GPS events can be processed because the realistic receiving system simulator is a pure GPS receiver).

- Random number seed:
The integer value of the random number seed can be set between 0 and 100, whereas 0 denotes the system clock.

- Technical specifications:
Several different features are connected together under this formal name. The system noise temperature, the number of interfering GPS satellites, the implementation loss, the antenna internal loss and the interference misalign loss.

- Loop specifications:
For open-loop tracking two different atmosphere models are available (the Biexponential- or a SAE-Fit atmosphere model). But it is also possible to turn the open-loop tracking off. Also adjustable are the loop period values and the start time of the 2nd value.

- FLL specifications:
It allows to specify the stop time and the filter order for the Frequency-Locked Loop (FLL) of the realistic receiving system simulator.

- Filter Specifications:
Adjustment of the L1- and CA filter specification allows for each filter the selection of the filter type and order, of the bandwidth values and the start time of the 2nd value can be modified.

OSMod VISUALIZATION:

EGOPS provides for the visualization of results of Observation System Modeling tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for OSMod tasks, to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "observed excess phase" and "observed power", "observed" here in the sense of end-to-end simulated observables)

as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different OSMod tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

7.2.5 Occultation Data Inversion/Retrieval

GENERAL DESCRIPTION

Inversion/Retrieval of occultation data denotes the processing of simulated or observed phase and amplitude data (supplemented by the necessary geometrical information) typically via Doppler shifts and bending angles down to quasi-vertical atmospheric profiles of refractivity, density, pressure, temperature, and humidity.

This processing chain typically requires, sequentially, tools for ionospheric correction and conversion of the "raw" excess phase observables to neutral-atmospheric bending angle profiles, for inversion of bending angle profiles into refractivity profiles ("Inverse Abel Transform"), and for finally retrieving the atmospheric variables (e.g., temperature) from refractivity. The air (in the troposphere) may be considered either dry or moist in the last stage of this processing chain.

Another route of inversion (possible within EGOPS), directly leading from the raw observables to refractivity, is "Inverse Fresnel Transform": This method is CPU-expensive but exploits both phase and amplitude observables to resolve small-scale structures in the troposphere (down to the 100 m level), which are convolved in the observables due to atmosphericdiffraction. For the "Inverse Abel Transform", the resolution is "diffraction-limited" at the "Fresnel-scale" (being somewhat less than 1 km in the Earth's troposphere).

Necessary prerequisites for inversion/retrieval are either simulated observables, obtained by Observation System Modeling (OSMod) within EGOPS, or genuine observed phase and amplitude data (from the GPS/MET experiment).
[See "Help on Task - Help on Observation System Modeling" for more information on OSMod, and see, e.g., the WWW site "http://pocc.gpsmet.ucar.edu" for more information on the GPS/MET experiment and the data obtained.]

Such occultation data inversion/retrieval requires a considerable number of "free input parameters" in a simulation tool in order to allow for flexible data processing of widely arbitrary simulated GNSS occultation missions as well as for observed data. (See the section "InRet INPUT PARAMETERS" below for an overview on the respective functionality furnished by EGOPS. Details are found in the On-line Help within the "InRet Input" interface window available via the "Task" menu.)

Furthermore, it is necessary to have convenient tools for visualization and validation of the simulation results available in order to carry out simulation studies efficiently and in order to effectively comprehend and interpret the results. (See the section "InRet VISUALIZATION" below for a crude overview on the respective functionality furnished by EGOPS. A refined overview is given under the "Help on Visualize/Val. - Help on Visualize/Val. Profiles" entry of the "Help" menu. Details are found in the On-line Help within the "Visualize/Validate Profiles" interface window available via the "Visualize/Validate" menu.)

InRet INPUT PARAMETERS

EGOPS allows to compute Occ. Data Inversion/Retrieval tasks taking into account the set of "free input parameters" outlined below, which all together provide considerable flexibility and potential for Occultation Data Inversion/Retrieval. All these parameters can be - within their range of validity - freely set by the User just as desired for a specific InRet task.

The "InRet Input" window, available via the "Occ. Data Inv./Retrieval" entry of the "Task" menu, is the convenient interface EGOPS provides for the supply of all of these parameters (including either the supply of a "Reference OSMod Task-id", providing for access to the input conditions and results of a prior OSMod task, or, alternatively, including the supply of a "GPS/MET data path", providing for access to User-prepared GPS/MET data files.)

- Type of occultation data to be processed:
Simulated data (prepared by prior OSMod tasks run within EGOPS), or GPS/MET data (prepared by the User in a directory to which at least read-access exists from the EGOPS installation; mandatory file format: the "UCAR Level 2 data" format).

  - Occultation event(s) selection in case of simulated data:
  Reference OSMod Task-id (to be selected from the list of suitable OSMod tasks existing within the current Project).
  Also, in case a sample of events is available for the selected Reference OSMod task, event number range (or individual event number) of desired event(s) within the available OSMod events.

  - Occultation event(s) selection in case of GPS/MET data:
  GPS/MET data path (full directory path of the directory where the desired GPS/MET data reside, e.g., /home/<usr>/gpsmet/level2/occ/95.294/).
  Also, in case a sample of events is available within the selected GPS/MET data directory, event number range (or individual event number) of desired event(s) within the available GPS/MET events.

- Choice of Retrieval Processing Specifications:
"General Atmospheric Processing" (default) for General Phase/Power-to-Refractivity Processing, or "Atmospheric Inverse Fresnel Transform", or "Ionosphere Processing", where the first selection allows the following further choices:

  - Choice of Bending Angle Retrieval Specifications:
  For bending angle retrieval, "IAP Differential Correction & Ionosphere Correction & Bending Angle Retrieval", "IMG/UoG Ionosphere Correction & Bending Angle Retrieval" (the latter being the default), "DMI Standard Ionosphere Correction & Bending Angle Retrieval", or "DMI Enhanced Ionosphere Correction & Bending Angle Retrieval".
  For IAP Diff. Corr. & Ion. Corr. & Bend. Angle Retrieval "No Diff. Correction", or "Backpropagation" is possible for the Diff. Correction Type (in case of "Backpropagation" the value of the Local Backpropagation Plane can be set). For IMG/UoG Ion. Corr. & Bend. Angle Retrieval and DMI Enhanced Ion. Corr. & Bend. Angle Retrieval the Ion. Correction Type can be varied between "Phase Correction" and "Bend. Angle Correction", whereas the Stat. Optimization Type can be chosen among "No Stat. Optimization", "Optimize invoking MSIS90_DMI", "Optimize invoking CIRA86aQ_UoG" in the first case and amongst "No Stat. Optimization", "Optimize using m+z BenA Search", and "Optimize using glob. BenA Search" in the latter case (for DMI Standard Ion. Corr. & Bend. Angle Retrieval both the Ion. Correction Type and the Stat. Optimization Type are insensitive).

  - Refractivity Profiles Retrieval Specifications:
  For the Refractivity Profiles Retrieval/Inversion Tool, "No Atmospheric Refractivity Profiles Retrieval", or "DMI Abel Transform Atmos. Refractivity Profiles Retrieval" are possible.

  - Retrieval tools in case of Atmospheric Inverse Fresnel Transform:
  For Atm. Inverse Fresnel Transform the Bending Angle Retrieval Tool is n/a and the Ion. Correction Type and the Stat. Optimization Type are also insensitive. The only allowed Refractivity Profiles Retrieval/

Inversion Tool is "DMI Inverse Fresnel Refractivity Profiles Retrieval".

- Retrieval tools in case of Ionosphere Processing:
For Ionosphere Processing the Bending Angle Retrieval Tool is constrained to "DMI Ionospheric Bending Angle Retrieval" and the Ion. Correction Type and the Stat. Optimization Type are insensitive. For the Refractivity Profiles Retrieval/Inversion Tool "No Ionospheric Refractivity Profiles Retrieval" or "DMI Abel Transform Ionos. Refractivity Profiles Retrieval" is allowed.

- Choice of Atmospheric Profiles Retrieval Specifications:

  - For the type of Atmospheric Profile Retrieval Tool:
  "No atmospheric profiles retrieval", or "DMI dry air profiles retrieval" (basic default), or "DMI/IMG moist air profiles retrieval", where the latter selection allows the following further choices:

  - For the type of moist air retrieval:
  "q,e,p,rho w. T prescribed (It)", or "q,e,p,rho w. T prescribed (In)", "q,e,rho with p,T prescribed", or "T,e,p,rho w. q prescribed (In)", or "T,e,rho with p,q prescribed", or "T,q,e,p,rho by Opt.Estimation...". The last one opens a pop-up window for the input of the Observation + ForwardModeling error covariance matrix specs and the background (T,q) error covariance matrix specifications.

  - Atmospheric model used for prescribed parameters:
  "FoMod atmosphere" (default in case of simulated data, meaning the atmosphere used in the "forward modeling" of the simulated observables), or "Bi-Exponential atmosphere", or "HLat 2D Atmosphere (CIRA86aQ_UoG)" (default in case of GPS/MET data), or the "GCM 3D Atmosphere (GCM3DAtm)", or the "HiVRes Atmosphere (HiVResAtm)...", or a "(Moist) User-supplied Atmosphere" (if moist air included in this atmosphere). [If you have a source-code version of EGOPS read the file usratm.SampleFile in the /prog/FORprog subdirectory of EGOPS in case you want to learn more about how to supply your own user supplied atmosphere.]

- Choice of Ionospheric Profiles Retrieval Specifications (only possible in case of Ionosphere Processing):

  - For the Ionospheric Profile Retrieval Tool:
  "No Ionosphere Profiles Retrieval", or "Electron Density Profiles Retrieval" are possible for selection.

InRet VISUALIZATION

EGOPS provides for the visualization of results of Occ. Data Inversion/Retrieval tasks by its "Visualize/Validate Profiles" window interface available via the "Visualize/Validate" menu.

The "Visualize/Validate Profiles" window interface allows, for InRet tasks, to post-process, validate against reference data, visualize, customize, compare, and print-out simulated or observed Doppler shift profiles (as function of occ. event time), bending angle profiles (as function of impact parameter), and refractivity, density, pressure, temperature, water vapor, and specific humidity profiles (as function of height). Also, in case of GPS/MET data, the original phase and amplitude data can be visualized (as function of occ. event time). The GPS/MET excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations.

The post-processing includes functionality to compute absolute and relative difference profiles between profiles of different InRet tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.
Furthermore, reference "ground-truth" profiles of refractivity, density, pressure, temperature, water vapor, and specific humidity can be prepared with any available atmospheric model within EGOPS, at the tangent point locations of the retrievals. Absolute and relative difference profiles w.r.t.

these reference profiles can then be computed, as well as difference profiles statistics (mean difference to "ground-truth" and standard deviations compared to "ground-truth") for samples of events.

Customization includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the time average value over a selected range of a profile (and to visualize this information by overplot on the original profile).
[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

7.3 Help on Visualize/Validate

7.3.1 About Visualize/Validate

GENERAL DESCRIPTION

The "Visualize/Validate" menu of EGOPS enables the User to post-process, compare to reference data (validate), visualize, and print-out result data of computational tasks carried out within the current project by employing one of the options of the "Task" menu previously. [See the "Help on Project" and "Help on Task" help entries to learn what EGOPS projects and tasks are.] In addition, it enables the User to visualize and visually explore atmospheric and ionospheric models within EGOPS, a capability useful for learning about the space-time behaviour of the simulated atmosphere/ionosphere system, e.g., in view of selecting domains of interest for specific simulation tasks.

Five different generic types for visualization are offered, which together provide a powerful and flexible capability for preparation of EGOPS tasks and visual analysis, comprehension and interpretation of results of EGOPS tasks by the User. These five types, each of which is briefly overviewed below (see the section "OVERVIEW on VISUALIZE/VALIDATE interfaces"), are available via window interfaces caused to pop-up by selecting one of the "Visualize/Validate" menu entries. Specifically, the types are "MAnPl Statistics" (MAnPl - Mission Analysis/Planning), "Geographic Maps", "Profiles", "Volume Data", and "Data Animation". The "Geographic Maps", "Volume Data", and "Data Animation" interfaces are available already without having assigned an EGOPS project via the "Project" menu (for visualizing atmosphere/ionosphere model information), while the others need a current project assigned (the data of which are then available for visualization/validation).

Each such window interface has a standardized 600x512 pixel graphics output window as well as its specific post-processing functionality seamlessly integrated with plot customization features such as adjusting graphics axes ranges, titles, legends, map projections, etc. .
A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file.

OVERVIEW on VISUALIZE/VALIDATE interfaces

"MAnPl Statistics..." - Visualize Mission Analysis/Planning Statistics:

The "MAnPl Statistics" interface allows to compute, visualize, and print-out 1D and 2D occultation coverage statistics as function of variables including latitude, longitude, Local Time, duration of occultation events, and obliquity (compared to vertical setting or rising) of tangent-point trajectories. Furthermore, it allows to compute, visualize, and print-out visibility statistics for fiducial and tracking sites, e.g., number of occultation events for which successful single- or double-differencing is possible by each of a given sample of fiducial sites, or number of orbits seen for a certain time range per orbit by each of a couple of tracking sites. Also statistical measures of number of events, (rms of) distances, (rms of) time separation as function of different latitude longitude cells or bands can be calculated and displayed. The basic data visualized in this way by the "MAnPl Statistics" interface are the result data from MAnPl tasks computed before under the "Mission Analysis/Planning" entry of the "Task" menu. The User selects specific MAnPl result data, out of all MAnPl data available within the current project, by assigning within the interface the Task-id of a desired MAnPl task.

[See "Help on Visualize/Val. - Help on Visualize MAnPl Statistics" for more information.]

"Geographic Maps..." - Visualize Geographic Maps:

The "Geographic Maps" interface allows to compute, visualize, and print-out latitude-longitude maps (using different map projections) showing occultation event coverage for arbitrary geographic areas and including information such as on the geometrical shape and time of each event.
The basic data visualized in this way by the "MAnPl Statistics" interface are the result data from MAnPl tasks computed before under the "Mission Analysis/Planning" entry of the "Task" menu. The User selects specific MAnPl result data, out of all MAnPl data available within the current project, by assigning within the interface the Task-id of a desired MAnPl task.

Furthermore, this interface allows to compute, visualize (stand-alone or as overplot to occultation event coverage maps), and print-out geographic maps of a series of atmospheric/ionospheric variables (e.g., temperature and electron density) from all atmospheric/ionospheric models available within EGOPS. These may either slice the atmospheric/ionospheric field at a certain height or be vertically integrated quantities (e.g., total precipitable water). The selection of such "maps data" for a desired parameter is possible from all map data for this parameter computed so far under EGOPS (and not deleted meanwhile in the /referdata/mapsdata subdirectory of EGOPS).

[See "Help on Visualize/Val. - Help on Visualize Geographic Maps" for more information.]

"Profiles..." - Visualize/Validate Profiles:

The basic data visualized by the "Profiles" interface are the result data of FoMod, or OSMod, or InRet tasks computed before under the "Forward Modeling" entry, or the "Observation System Modeling" entry, or the "Occ. Data Inv./Retrieval" entry of the "Task" menu. The User selects specific FoMod/OSMod/InRet result data, out of all FoMod/OSMod/InRet data available within the current project, by first selecting the generic type of Task (FoMod, or OSMod, or InRet) and then assigning the Task-id of a desired FoMod/OSMod/InRet task.

For FoMod tasks, the "Profiles" interface allows to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "atmospheric(/ionospheric) excess phase" and "atmospheric(/ionospheric) power loss") as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases) and LI data (ionosphere only at L1) are all available for visualization and inspection, stand-alone or in combinations. The amplitude data are available at L1 and L2 frequencies, stand-alone or in combination.

For OSMod tasks, the "Profiles" interface allows to post-process, visualize, customize, compare, and print-out simulated phase and amplitude data (in terms of "observed excess phase" and "observed power", "observed" here in the sense of end-to-end simulated observables) as function of occultation event time.
The excess phase data at the L1 and L2 frequencies as well as the LC data and LI data are all available for visualization and inspection, stand-alone or in combinations. The amplitude data are available at L1 and L2 frequencies, stand-alone or in combination.

For InRet tasks, the "Profiles" interface allows to post-process, validate against reference data, visualize, customize, compare, and print-out simulated or observed Doppler shift profiles (as function of occ. event time), bending angle profiles (as function of impact parameter), and refractivity, density,

pressure, temperature, water vapor, and specific humidity profiles (as function of height).
Also, in case of observed data (from the GPS/MET experiment), the original phase and amplitude data can be visualized (as function of occ. event time). The observed excess phase data at the L1 and L2 frequencies as well as the LC data and LI data are all available for visualization and inspection, stand-alone or in combinations. The observed amplitude data are available at the L1 and L2 frequencies, stand-alone or in combination.

For all generic Task options (FoMod, OSMod, and InRet), the post-processing includes functionality to compute absolute and relative difference profiles between profiles of different tasks or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events.
Furthermore, for InRet tasks, reference "ground-truth" profiles of refractivity, density, pressure, temperature, water vapor, and specific humidity can be prepared with any available atmospheric model within EGOPS, at the tangent point locations of the retrievals. Absolute and relative difference profiles w.r.t. these reference profiles can then be computed, as well as difference profiles statistics (mean difference to "ground-truth" and standard deviations compared to "ground-truth") for samples of events.

Again, for all generic Task options (FoMod, OSMod, and InRet), convenient customization functionality is available which includes, among other features, functionality to fit an exponential or polynomial of user-specified order to a selected range of a profile or to compute the average value over a selected range of a profile (and to visualize this information by overplot on the original profile).

[See "Help on Visualize/Val. - Help on Visualize/Val. Profiles" for more information.]

"Volume Data..." - Visualize Volume Data:

The "Volume Data" interface allows to compute arbitrary 3D subdomain cubes (up to 101 x 101 x 101 grid points), cut out of the generic 5D space-time domain (height-latitude-longitude-UT-month) of EGOPS' atmospheric model parameters or the generic 6D space-time domain (height-latitude-longitude-UT-month-solar activity) of EGOPS' ionospheric model parameters, respectively. The atmospheric parameters available as such "volume data" include temperature, pressure, density, refractivity, water vapor (pressure), and specific humidity. The ionospheric parameters include electron density and ionospheric refractivity (at the GPS/L1 frequency).

Such volume data for a given parameter, the selection of which is possible from all volume data for this parameter computed so far under EGOPS (and not deleted meanwhile in the /referdata/volumdata subdirectory of EGOPS), can then be visualized and printed out in form of arbitrary 2D slices taken out of the 3D subdomain cubes.

[See "Help on Visualize/Val. - Help on Visualize Volume Data" for more information.]

"Data Animation..." - Visualize Data Animation:

The "Data Animation" interface allows to compute arbitrary 3D subdomain cubes precisely as the "Volume Data" interface allows. Also, the selection of such 3D cubes for a desired parameter is in the same way possible from all volume data for this parameter computed so far under EGOPS (and not deleted meanwhile in the /referdata/volumdata subdirectory of EGOPS).

However, instead of static display/print-out, the "Data Animation" interface allows to animate arbitrary 2D slices through the 3D cubes along the 3rd dimension. In other words, selecting one dimension as the "time axis" of the movie (along which the animation will proceed), one can visually explore the 3D cube in terms of motion pictures, the pictures given by the 2D slices orthogonal to the "time axis". A series of convenient features available such as backward/forward/bounce/pause modes, movie speed regulation, step-by-step inspection, and with/without contours display make this interface an ideal tool for very effectively learning about the space/time behaviour of EGOPS' atmosphere/ionosphere models.

[See "Help on Visualize/Val. - Help on Visualize Data Animation" for more information.]

7.3.2 Visualize Mission Analysis/Planning Statistics

GENERAL DESCRIPTION

The "Visualize Mission Analysis/Planning Statistics" window interface is called via the "MAnPl Statistics..." entry of the "Visualize/Validate" menu.

The basic data visualized by the interface are the result data from MAnPl tasks computed under the "Mission Analysis/Planning" entry of the "Task" menu previously. The User selects specific MAnPl result data, out of all MAnPl data available within the current project, by first assigning within the interface the Task-id of a desired MAnPl task.

Having assigned an "Occultation" MAnPl/Task-id, information on the main input parameters of the current task is displayed at the top of the window, including UT range, height level range (for "Reflection" MAnPl/Task-ids the time step is shown instead of the undefined height level ranges in this case), and the geographic area covered. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations possible for the result data of the current task are occultation (reflection) coverage statistics computations and visibility statistics for fiducial and tracking sites. [See, e.g., the "Help on Task - Help on Mission Analysis/Planning" function to learn what fiducial and tracking sites are.] These computations are performed within post-processing pop-up windows of the interface, which are accessed via the "Compute Occ. Statistics..." or "Compute Refl. Statistics..." and "Compute Vis. Statistics..." buttons.

Occultation (reflection) coverage statistics computations yield 1D and 2D statistics data in form of histogram data (discrete event distribution functions over a 1D or 2D domain). Options available for 1D statistics include the number of events taking place in bins of user-specified width over latitude, or longitude, or Local Time, or duration of events, or obliquity of tangent-point trajectories (w.r.t. to a vertical set or rise of the tangent point). Options available for 2D statistics include the number of events taking place in boxes of user-specified size over longitude-latitude maps, or Local Time-latitude maps, or event duration-latitude maps, or event obliquity-latitude maps. It is also possible to calculate statistical measures for occultation (reflection) tasks. Different options for statistical measures are Number of Events per unit area, mean Distances, rms of Distances, mean Time Separation, and rms of Time Separation.

Visibility statistics computations yield, for each of a given set of LEO receivers involved in the current MAnPl task, the number of occultation events for which successful ground- or spacebased single differencing or double-differencing is possible by each of a given sample of fiducial ground sites (and by all sites together) or additional LEO-satellites, and the number of orbits seen for a given time range per orbit by each of a couple of tracking ground stations (and by all stations together).

The post-processing result data are saved in "display files" which are named with the Task-id of the current task and which indicate through their file extension the type of processing (and, for a given type, the version). For instance "MAnPltest1.Lat02" contains, for a current task named "MAnPltest1", the results of the 2nd post-processing run ("02") for 1D histogram data versus latitude ("Lat").

All "display files" computed so far for the current task are basically available to be visualized. For visualizing a specific result, the User needs to first select the type desired (for 2D histogram data also whether these shall be plotted as 2D histograms or 2D contours) and then the version desired (i.e., the actual "display file" among all versions available for the selected type).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, and the axes ranges (and viewing angle in case of 2D histogram plots). However, these plot settings can also be adjusted by the User before plotting. In addition, the User can decide whether to plot the data directly as they appear in the "display files" (as numbers of events), or "equal area-weighted" (in case occ. statistics data include a dependence on latitude), or "as percentages" (in case of visibility statistics data).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode (for statistical measures data the four-panel mode is not foreseen), and "plot", "overplot", and "erase last" or "erase all" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /<Project-id>/PSfiles subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Mission Analysis/Planning Statistics" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some MAnPl tasks, then pop-up this interface and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

7.3.3 Visualize Geographic Maps

GENERAL DESCRIPTION

The "Visualize Geographic Maps" window interface is called via the "Geographic Maps..." entry of the "Visualize/Validate" menu.

The basic data visualized by the interface are the result data from MAnPl tasks computed under the "Mission Analysis/Planning" entry of the "Task" menu previously. The User selects specific MAnPl result data out of all MAnPl data available within the current project, by first assigning within the interface the Task-id of a desired MAnPl task. Furthermore, even if no project is currently opened, geographic maps of atmospheric/ionosphere variables can be visualized.

Having assigned a MAnPl/Task-id, information on the main input parameters of the current task is displayed at the top of the window including UT range, height level range, and the geographic area covered. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations, possible for the result data of the current task, yield occultation/reflection event distribution data. These data, more specifically also termed "ground projection data", include information on the geometrical shape (approximate ray-path tracks about the tangent-point trajectory for a given height level range for occultation tasks, or iso-range and iso-doppler curves for reflection tasks), the type (set or rise, GPS or GLONASS), the occurrence in time, and the sequential occultation/reflection event number (within the simulated time interval) of each event (within a selected sample of events). The computations are performed within a post-processing pop-up window of the interface, which is accessed via the "Prepare Occ./Refl. Event Data..." button.

The post-processing result data are saved in "display files" which are named with the Task-id of the current task and which indicate through their file extension the type of processing ("GrProjD" for "Ground Projection Data") and the version. For instance, "MAnPltest1.GrProjD02" contains, for a current task named "MAnPltest1", the results of the 2nd post-processing run ("02") for ground projection data ("GrProjD").

In order to prepare geographic maps of parameters of atmospheric/ionospheric models available within EGOPS, 2D latitude-longitude grids of such parameters can be computed (independent of whether a project is open or not). These grids may either slice an atmosphere/ionosphere field at a selected height (possible for temperature, pressure, density, refractivity, water vapor (pressure), specific humidity, electron density, and ionospheric refractivity (at the GPS/L1 frequency)) or contain vertically integrated quantities (possible for Precipitable Water and Total Electron Content).
These computations are performed within a processing pop-up window of the interface, which is accessed via the "Prepare Atm/Ion Model Data..." button.

The maps data are saved in "display files" (under the /referdata/mapsdata subdirectory of EGOPS) which are named with the acronym of the atmosphere/ionosphere model from which they originate plus the acronym of the parameter mapped. With their extension the files indicate their type ("Map") and the version. For instance, "MSIS90_DMI-Temp.Map01" contains, from the 1st computation for the specific model and parameter ("01"), a geographic map of temperature from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed so far are basically available to be visualized (if no project is open, the atmosphere/ionosphere model maps only).
For visualizing a specific result, the User needs to first select the type desired (either event distribution data or atmosphere/ionosphere model data) and then the version desired (i.e., the actual "display file" among all versions available for the selected type).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the map projection, and the map area (and the contour levels in case of atmosphere/ionosphere model data). However, these plot settings can also be adjusted by the User before plotting. In addition, the User can decide whether to plot the data directly as they appear in the "display files" (as ground projection data showing ray-path tracks about the tangent-point trajectories in case of event distribution data or as contoured 2D images in case of atm/ion model data), or "tagged with occ./refl.event number" (in case of event distr. data), or "tagged with event times" (also in case of event distr. data), or "overplotted on event distr. data" (in case of atm/ion model data). Several important tags can be included for improving the plotting quality (Plot Tangent Point with accumulated UT tags, with LT tags, with GNSS-Id tags, with LEO-Id tags or Plot Tangent Point with GNSS+LEO-Id tags).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the

User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (basically in the /<Project-id>/PSfiles subdirectory of EGOPS except for atm/ion data maps, for which the file is directed to the /referdata/mapsdata subdirectory) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Geographic Maps" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some MAnPl tasks and maps of atmosphere/ionosphere model parameters, then pop-up this interface and try out the functionality by a "look-and-feel" approach.
  Where necessary, make a sidekick to a specific On-line Help topic.
  Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

7.3.4 Visualize/Validate Profiles

GENERAL DESCRIPTION

The "Visualize/Validate Profiles" window interface is called via the "Profiles..." entry of the "Visualize/Validate" menu.

The basic data visualized by the "Profiles" interface are the result data of FoMod, or OSMod, or InRet tasks computed before under the "Forward Modeling" entry, or the "Observation System Modeling" entry, or the "Occ. Data Inv./Retrieval" entry of the "Task" menu. The User selects specific FoMod/OSMod/InRet result data, out of all FoMod/OSMod/InRet data available within the current project, by first selecting the generic type of Task (FoMod, or OSMod, or InRet) and then assigning the Task-id of a desired FoMod/OSMod/InRet task.

Having selected a generic type of Task and assigned a corresponding Task-id, information on the occultation event no. range, the generic file names, and the total number of occultation events of the current task is displayed at the top of the window. In addition, full information on the input of the current task can be displayed (and printed out if desired) by one mouse click, at any time during the visualization.

The post-processing computations possible for the result data of the current task are absolute and relative difference profiles between profiles of different tasks (of the same generic type) or within a sample of events as well as profile statistics (mean and standard deviation profiles) for samples of events. For visualization of statistics, also standard-deviation-of-mean profiles are automatically included being a function of the computed mean and standard deviation profiles.
These computations are performed within a post-processing pop-up window of the interface, which are accessed via the "Profiles Post-Processing..." button.

For FoMod tasks, the basically available result data for this post-processing comprise "ideal" simulated phase and amplitude data (in terms of "atmospheric (ionospheric) excess phase" and "atmospheric (ionospheric) power loss") as function of occultation event time. The excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (neutral atmosphere only after linear ionospheric combination of L1/L2 phases). For visualization, also LI data (ionosphere only at L1) are automatically included being a function of the computed L1, L2, and LC data. The amplitude data are available at the L1 and L2 frequencies.

For OSMod tasks, the basically available data comprise "realistic" simulated phase and amplitude data (in terms of "observed excess phase" and "observed power", "observed" here in the sense of end-to-end simulated observables) as function of occultation event time. The excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (for visualization, also LI data are then derived), the amplitude data at L1 and L2.

For InRet tasks, the basically available data comprise simulated or observed Doppler shift profiles (as function of occ. event time), bending angle profiles (as function of impact parameter), and refractivity, density, pressure, temperature, water vapor, and specific humidity profiles (as function of height). Also, in case of observed data (from the GPS/MET experiment), the original phase and amplitude data are available (as function of occ. event time). The observed excess phase data are available at the L1 and L2 frequencies as well as in form of LC data (for visualization, also LI data are then derived), the amplitude data at L1 and L2.

Furthermore, for InRet tasks, reference "ground-truth" profiles of refractivity, density, pressure, temperature, water vapor (pressure), and specific humidity can be prepared with any available atmospheric model within EGOPS, at the tangent point locations of the retrievals.
These computations are performed within a processing pop-up window of the interface, which is accessed via the "Prepare Atm.Ref. Profiles..." button.
Absolute and relative difference profiles w.r.t. these reference profiles can then be computed, as well as difference profiles statistics (mean difference to "ground-truth" and standard deviations compared to "ground-truth") for samples of events. For visualization of these statistics, also standard-deviation-of-mean profiles are automatically included being a function of the computed mean and standard deviation profiles.
These computations, in turn, are again performed within the "Profiles Post-Processing..." pop-up window noted a few paragraphs above.

The post-processing result data are saved in "display files" which are named with the Task-id of the current task (plus the occultation number if not profile statistics) and which indicate through their file extension the parameter concerned, the type of processing, and, for a given type, the version. For instance "InRettest1_0001.TempDif03" contains, for occultation profile no. 1 ("_0001") of a current task named "InRettest1", the results of the 3rd post-processing run ("03") for a difference profile ("Dif") between temperature profiles ("Temp").
In case of atmospheric reference profile "display files", the original profile's file extension is extended by the acronym of the atmospheric model which serves as "ground-truth" atmosphere. For instance, the file "InRettest1_0001.TempMSIS90_DMI" would contain a temperature reference profile extracted from the dry 3D atmosphere model MSIS90_DMI which is co-located with the profile in "InRettest1_0001.Temp".

All "display files" computed so far for the current task are basically available to be visualized. For visualizing a specific result, the User needs to first select the parameter and the type desired (e.g., difference profiles of temperature) and then the "display file" desired (out of all available ones for the selected parameter and type, which typically may cover a range of occultation numbers and/or versions).

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the axes ranges, and the parameter axis type (default linear, another option is logarithmic in case of direct plotting of positive definite result profiles or their atmospheric reference profiles). However, these plot settings can also be adjusted by the User before plotting. After plotting the "zoom in..." button can be used for enlarging interesting details of the plot (the "restore..." button can be used afterwards to restore the original plot image size).

In addition, the User can decide whether to plot the profiles directly as they are obtained from "the display files" (as functions of time, or impact parameter, or height, dependent on the parameter) or whether the data shall be customized in various ways before plotting.
The customization functionality (available always to the extent appropriate for a selected generic type of Task, parameter, and type of plot) includes a function for smoothing the profile data by a user-specified sliding filter width, a function to compute the average value over a selected range of a

profile, functions to fit an exponential or a polynomial of user-specified order to a selected range of a profile, a function to select arbitrary profile subsets of the L1, L2, LC, and LI data available (in case of excess phase or Doppler shift data, L1/L2 in case of amplitude data with the ability to visualize, for simulated amplitude observables, absolute or relative power), and a function to select arbitrary profile subsets of the mean, standard deviation, and standard-deviation-of-mean profiles available (in case of statistics data, with the ability to show absolute or relative standard deviations).

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /<Project-id>/PSfiles subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

Additionally, the line style and line thickness can be directly varied by means of two droplist buttons. The annotate function allows to individually create text strings for later annotation of the plot window. Several different text parameters can be altered (i.e. the text alignment, color, direction, position, and the text size). About 16 different character sets are available for creating a text string. These text strings can also be stored for later reuse.

[Detailed help on each function of the "Visualize/Validate Profiles" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Prepare some FoMod/OSMod/InRet tasks, then pop-up this interface and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

7.3.5 Visualize Volume Data

GENERAL DESCRIPTION

The "Visualize Volume Data" window interface is called via the "Volume Data..." entry of the "Visualize/Validate" menu. Its operation is independent of whether a project is currently opened or not.

The interface allows to compute, visualize, and print-out "volume data". Such "volume data" within EGOPS are arbitrary 3D subdomain cubes, cut out of the generic 5D space-time domain (height-latitude-longitude-UT-month) of EGOPS' atmospheric model parameters or the generic 6D space-time domain (height-latitude-longitude-UT-month-solar activity) of EGOPS' ionospheric model parameters, respectively. Cube dimensions up to 101x101x101 data points are allowed, and the volume data may be extracted from any of the atmospheric/ionospheric models available within EGOPS.

The atmospheric parameters available include temperature, pressure, density, refractivity, water vapor (pressure), and specific humidity. The ionospheric parameters include electron density and ionospheric refractivity (at the GPS/L1 frequency).

The preparation of the volume data sets is performed within a processing pop-up window of the interface, which is accessed via the "Compute 3D Atm/Ion Model Data..." button.

The computed volume data are saved in "display files" (under the /referdata/volumdata subdirectory of EGOPS) which are named with the acronym of the atmosphere/ionosphere model from which they originate plus the acronym of the parameter concerned. The filename extension indicates the data type ("Vol") and the version. For instance, "MSIS90_DMI-Temp.Vol01" contains data from the 1st computation of a specific model and parameter ("01") and a 3D subdomain cube of temperature from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed so far are basically available to be visualized. For visualizing a specific volume data set, the User needs to first select the parameter desired (either an atmospheric or ionospheric one) and then a "display file" desired (out of all available ones for the selected parameter, which typically may cover different models and versions). The visualization itself is performed in form of arbitrary 2D slices taken out of the selected 3D subdomain cube which are depicted as contoured images.

Having selected a "display file", immediate on-screen plotting is possible into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the dimension which is held fixed and its fixed value (the 2D slice spanned by the other two orthogonal dimensions is singled out just at this value), the axes ranges of the 2D slice, and the contour levels to be shown. However, these plot settings can also be adjusted by the User before plotting.

The standardized graphics output window can be used in one-panel, two-panel (stacked vertically), or four-panel mode, and "plot", "overplot", and "erase" functions can be quite arbitrarily employed. In addition, a "colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately affect the current graphics allowing for efficient color optimization. EGOPS V4.0 allows additionally to switch between the image/contours or the contour fill mode for plotting. Also several different contour line colors are available for an easier line recognition.

A very useful new feature is the profiles pop-window for showing horizontal- or vertical volume data profiles. To create the volume data profiles the mouse cursor has to be moved over the whole volume data plot. Then the data profile will be simultaneously displayed in an extra graphic pop-window beside the standard volume data graphics window. It can be switched (via mouse click) between an horizontal- or an vertical data profiles mode and, at any time during visualization, the volume data profile can be saved to disk.

A "Print to PostScript file" function conveniently allows immediate publication-quality printing at any time during visualization when the User considers it appropriate to conserve the current on-screen graphics as print file. A color PostScript file is generated (always in the /referdata/volumdata subdirectory of EGOPS) so that either a color printer may be employed to get the full colored graphics on paper or a standard b/w printer to get the grayscale/black/white analog of the on-screen plot on paper.

[Detailed help on each function of the "Visualize Volume Data" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Pop-up the interface, prepare some volume data sets, and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

7.3.6 Visualize Data Animation

GENERAL DESCRIPTION

The "Visualize Data Animation" window interface is called via the "Data Animation..." entry of the "Visualize/Validate" menu. Its operation is independent of whether a project is currently opened or not.

The interface allows to compute and visualize (by animation) "volume data". "Volume data" within EGOPS are arbitrary 3D subdomain cubes, cut out of the generic 5D space-time domain (height-latitude-longitude-UT-month) of EGOPS' atmospheric model parameters or the generic 6D space-time domain (height-latitude-longitude-UT-month-solar activity) of EGOPS' ionospheric model parameters, respectively. Cube dimensions of up to 101x101x101 data points are allowed, and the volume data may be extracted from any of the atmospheric/ionospheric models available within EGOPS.

The atmospheric parameters available include temperature, pressure, density, refractivity, water vapor (pressure), and specific humidity. The ionospheric parameters include electron density and ionospheric refractivity (at the GPS/L1 frequency).

The preparation of the volume data sets is performed within a processing pop-up window of the interface, which is accessed via the "Compute 3D Atm/Ion Model Data..." button. (This pop-up window is in fact the identical one as that accessed within the "Visualize Volume Data" interface.)

The computed volume data are saved in "display files" (under the /referdata/volumdata subdirectory of EGOPS) which are named with the acronym of the atmosphere/ionosphere model from which they originate plus the acronym of the parameter concerned. The file name extension indicates the type ("Vol") and the version. For instance, "MSIS90_DMI-Temp.Vol01" contains data from the 1st computation of a specific model and parameter ("01") a 3D subdomain cube of temperature values from the dry 3D atmosphere model MSIS90_DMI.

All "display files" computed are basically available to be visualized. For visualizing a specific volume data set, the User needs to first select the desired parameter (either an atmospheric or ionospheric one) and then a "display file" (out of all available ones for the selected parameter, which typically may cover different models and versions).

So far, the computation and selection of specific volume data is in fact identical to that within the "Visualize Volume Data interface. However, instead of enabling static display and print-out of 2D slices through the 3D subdomain cubes, this interface allows to animate arbitrary 2D slices through the 3D cubes along the 3rd dimension. In other words, selecting one dimension as the "time axis" of the "movie" (along which the animation will proceed), one can visually explore the 3D cube in terms of motion pictures, the pictures given by the 2D slices orthogonal to the "time axis". The 2D slices are depicted as 2D images with or without contours. Thus, this interface is an ideal tool for very effectively learning about the space/time behavior of EGOPS' atmosphere/ionosphere models.

After having selected a "display file", an immediate start of the animation is possible, kicking off the "loading" of 2D slices into the standardized 600x512 pixel graphics output window integrated into the visualization interface. This will take default settings for the title, the plot legend, the dimension along which the animation shall proceed (the 2D slices spanned by the other two orthogonal dimensions will then constitute the motion pictures), the range of values along the animation dimension, the axes ranges of the 2D slices, and the contour levels to be shown (default is no contour levels). However, these plot settings can also be adjusted by the User before starting the animation.

The graphics output window, after having started the animation and loaded the relevant 2D slices, shows the animation while it can be customized by a series of convenient functions. These include backward, forward, bounce, and pause modes, movie speed regulation, real-time slice number information, and arbitrary browsing through the slice series by step-by-step inspection. In addition, a "Colors..." function furnishes a small pop-up window, which allows a very convenient and versatile handling of a multitude of color customization possibilities, which immediately effect the current graphics, allowing for efficient color optimization. "Stop" and "Erase" functions complete the primary features, allowing for stopping and clearing up a current animation.

EGOPS allows additionally to switch between the image/contours or the contour fill mode for data animation. The color/volume or color/slice are two different animation color range modes. In the color/volume mode, the colors for each slide are physically compatible (the same data value in each slide has the same color), whereas in the color/slice mode, the full color range is used for each individual slice, which means that the colors for different slices can have different meanings. Also several different contour line colors are available for an easier line recognition.

The "MPEG Output" function conveniently allows to save the currently loaded data animation sequence as an MPEG video file. In this form the data video file can be easy transferred to another users (which don't need EGOPS to run the animation, only a common MPEG player is necessary for replaying the animated data sequence).

[Detailed help on each function of the "Visualize Data Animation" interface is found in the On-line Help available within the interface.]

SPECIAL NOTES/HINTS

- The best way to get quickly acquainted with this visualization interface is certainly "learning by doing". Pop-up the interface, prepare some volume data sets, and try out the functionality by a "look-and-feel" approach. Where necessary, make a sidekick to a specific On-line Help topic. Given you are sure about what you want to compute and see, how to do it will soon be no problem for you.

7.4 Help on Help

7.4.1 About the Help Menue

GENERAL DESCRIPTION

The "Help" menu of EGOPS provides the User with On-line access to all information necessary to understand and use the software package and all of its main components and functions.
(This main-level Help information is complemented by detailed Help on each specific function of EGOPS, which is available within the pop-up window interfaces; cf. "Help on Help - Help within User I/F Windows".)

The entries of the "Help" menu comprise, in terms of type of help, the following two groups (of which the contents and structure is briefly outlined):

1) Help on the menus of EGOPS and all functions offered by these menus (including, as main entries, "Help on Project", "Help on Task", "Help on Visualize/Validate", and "Help on Help"):

This Help is directed mainly at the "working" User, who more or less recently started with EGOPS and seeks information and use support on the different main-level menus and/or any of the entries they offer. The latter represent the main functions of the software (i.e., the basic User I/F windows).

For convenience, the organization of the entries of this 1st Help group directly reflects the EGOPS menu structure (from left to right), i.e., the four entries of the Help group are "Project", "Task", "Visualize/Validate", and "Help". In particular, the subdivision of the first three entries ("Project", "Task", and "Visualize/Validate") directly reflects the ordering of the respective menu entries, whereby on top of these entries always one entry is included with general information on the rationale of the whole menu. For instance - reflecting the structure of the "Task" menu - the entry "Help on Task" of the "Help" menu contains the list of entries "About Tasks", "Help on Mission Analysis/Planning", "Help on Forward Modeling", "Help on Observation System Modeling", and "Help on Occ. Data Inversion/Retrieval".

The entry on "Help on Help", is divided into "About the Help Menu", explaining the Help function at the main level, and "Help within User I/F Windows", explaining the Help function within the pop-up window interfaces.

2) General Help, offering a basic understanding of EGOPS, technical and other helpful notes on setup and use, and a product information entry (including, as main entries, "EGOPS explained...", and "About EGOPS..."):

This Help is directed mainly at the new User, who wants to learn EGOPS basics like scientific background of EGOPS, the functionality and scope offered, the underlying concept and structure, and about sources for further written documentation about EGOPS. In addition, this Help provides Users with helpful notes on setup and usage of the software and with answers to Frequently Asked Questions (FAQs).

The above information (accessed via the "EGOPS explained..." entry) is completed with a concise product information (accessed via the "About EGOPS..." entry) giving product name, version, release, copyright, development team, a "disclaimer of warranty" statement, points of contact, and an informal section on distribution and transfer.

7.4.2 Help within User I/F Windows

GENERAL DESCRIPTION

The "Help within User I/F windows" function, which is available via the "Help" button at the bottom right of each pop-up window interface of EGOPS, provides the User with On-line access to all information necessary to understand and use each specific function.

This Help is directed to furnish the "working" User with "sidekick" information and provide support on all actions (e.g., selections by mouse click, input of numbers, etc.) the User can potentially perform within the given I/F window. For each of the User input parameters, Help is provided, as applicable, on its purpose, its type, its format and usage, its (range of valid) values, and its availability and side effects within the window's context. Usually, the Help also contains some example(s) for correct use of a parameter.

For convenience, the organization and ordering of the Help entry list accessible via the I/F window's "Help" button directly reflects the top-to-bottom layout and logical grouping of the given I/F window. Basically, one Help entry is provided per logical "input group" (comprising one or more parameters), which gives access to general information on the group (plus some special notes or hints, if deemed useful) and to the Help on the group's parameter(s). The naming of a Help entry directly follows the naming of the "input group" in the I/F window.
This way, the position of a Help entry is quickly found in the list of entries.

For the main User I/F windows, which are those directly accessed via the main-level menu entries, its Help entry is always on top of the list of "input group"-specific entries and gives general information on the whole window. In fact, this entry furnishes exactly the same information as is available via the main-level "Help" menu for the corresponding main-level menu entry.

For instance, the "Help" button within the "Mission Analysis/Planning Input"

User I/F window, which is accessed via the "Mission Analysis/Planning" button of the "Task" menu, furnishes a top entry called "Help on Mission Analysis/Planning". - This entry leads to the same information as provided by the "Help on Task - Help on Mission Analysis/Planning" entry, accessed via the main-level "Help" menu.

And as an example for an arbitrary selection, if the User desires to get Help on how to supply the "Height Levels" within the "Mission Analysis/Planning Input" window, which is the third "input group" from top within this window, the corresponding entry is found as third below the top entry in the Help entry list.

7.5 EGOPS explained

7.5.1 EGOPS Background

SCIENTIFIC-TECHNICAL BACKGROUND AND POTENTIAL OF GNSS OCCULTATION

The Global Navigation Satellite System (GNSS, presently GPS/GLONASS) enables active limb sounding of the Earth's atmosphere and ionosphere by placing GNSS receivers into Low Earth Orbits (LEO) and employing the radio-occultation (RO) technique.

The RO method bears great utility for fields like operational meteorology, climate monitoring and modelling, and space weather, due to its potential to globally, and under practically all weather conditions, yield virtually bias-free profiles of fundamental atmospheric parameters, such as temperature and humidity, with quite unique vertical resolution (1 km or better) and accuracy (e.g., temperature < 1K).

The RO technique has been employed, from the mid-1960s onwards, with great success by planetary missions to measure vertical profiles of density and temperature for the atmospheres of Venus, Mars and the outer planets.
With the advent of the GNSS satellites, which are high performance radio transmitters in high orbits (about 20000 km) furnishing suitable L-band signals near 1.2 GHz and 1.6 GHz, along with GNSS receivers in LEO, it is now possible to make RO measurements of great utility, as noted above, also for the Earth's atmosphere.

The scientific basis of the RO technique is as follows. When radio waves pass through the atmosphere, they are refracted through an angle determined by the refractivity gradients along the path. These, in turn, depend on the gradients of density (and hence temperature), water vapor and electron density, and so a measurement of the refraction angle contains information on these atmospheric/ ionospheric variables. These effects are most pronounced when the radiation traverses a long atmospheric limb path. Measurements for a series of such paths at different tangent heights, by exploiting the eigenmotions of orbiting GNSS and LEO satellite pairs in suitable geometry, contain information on the near-vertical profile of refractivity.

Though it is not possible at radio frequencies to measure the refracted angle directly, the refraction introduces an additional Doppler shift into the received signal, and this (or the related excess phase shift) can be measured very accurately and is directly related to the refraction angle.

An RO profile measurement by a receiver in LEO, which performs high-performance (millimetric precision), high-rate (50 Hz or so) tracking of a GNSS signal occulted by the atmosphere near the Earth's limb, takes a period of about 1 minute, just before or after eclipse with respect to the transmitter. Scannings from top down (space to Earth's surface) are called "setting" occultations, those from bottom upwards (surface to space) are called "rising" occultations.

A receiver on a LEO can obtain up to 29 occultation profiles per day for each GNSS transmitter. Given the operational network of GPS and GLONASS transmitters (48 satellites) and typical antennae field-of-view of GNSS receiver antennae, this allows more than 1000 globally distributed soundings per day for one

receiver in LEO (with an average horizontal spacing of about 700 km).
A constellation of successively more receivers reduces this horizontal spacing significantly (e.g., a 12-receiver constellation would reduce the average horizontal spacing to about 200 km per day).

In the stratosphere and upper troposphere, where the water vapor density is low, refraction variability is dominated by vertical temperature gradients, and the temperature profile can be retrieved accurately. In the lower troposphere, the water vapor effects are dominant, and the water vapor profile can be retrieved accurately (given temperature, but allowing for typical uncertainties in the prior knowledge of temperature). The height below which the information in the measurements is predominantly on water vapor varies with absolute humidity (and hence latitude); in the tropics it is typically around 7-8 km, whereas in the driest polar atmospheres, accurate temperature sounding is possible down into the planetary boundary layer (which extends up to about 1 km above the surface).

For both temperature and humidity sounding, it is necessary to account for the effects on the signals of refraction in the ionosphere. Correction for these effects can be made using RO signals at two radio frequencies available (about 1.2 GHz and 1.6 GHz), at which the effects of the ionosphere are substantially different. In addition, exploited in a complementary way, the presence of such effects provides accurate information on the ionosphere's electron density field.

Important features of the RO technique are its "all-weather" capability and the "long-term" stability (i.e., virtual absence of biases and drifts) of RO data. Most clouds have negligible effects on the measured signals. Even when a signal is attenuated a little (e.g., by rain), the measurement is not significantly degraded since the important measurement is of frequency shift (or excess phase), not of amplitude. For the same reason, the measurements have intrinsically high long-term stability, with no significant calibration problems. This feature is particularly important for climate monitoring and allows to directly combine data from different satellites and separated in time for many years.

EGOPS is a tool prepared to provide significant and effective help in addressing most of the open scientific and technical questions on the GNSS-based RO technique.

DEMONSTRATION OF THE POTENTIAL OF GNSS OCCULTATION

The potential of the GNSS-based RO technique has recently been demonstrated by early results from the GPS Meteorology (GPS/MET) experiment launched in April 1995 on the satellite Microlab 1. The results for temperature profile retrieval are already approaching the accuracies claimed for the technique.
In the northern hemisphere extra- tropics, standard deviations of difference between GPS/MET retrievals and European Center for Medium Range Weather Forecast (ECMWF) analyses are around 1-1.5K, with biases below 0.5 K.
In the southern hemisphere, agreement is also good in general, but with clear evidence that the RO measurements can identify where the ECMWF temperature analysis is deficient through lack of observations. A particularly impressive result of the GPS/MET data has been the ability to resolve the detailed temperature structure around the tropopause, in good agreement with collocated radiosondes.

The hitherto results are consistent with expected errors for this technique, i.e., less than 1 K, at a vertical resolution of 0.5-1 km in the upper troposphere and lower stratosphere, increasing to about 2 Kelvin near the stratopause (about 50 km).
EGOPS will be a significant tool to study open questions regarding various components of the error budget.

The potential accuracy of RO measurements has also been assessed for water vapor. Better than 10% accuracy has been estimated for the lowest about 2 km throughout the tropics and mid-latitudes, and also, at low latitudes, for the mid-troposphere at pressures exceeding about 600 hPa.
EGOPS can also play a significant role in better quantifying the potential of GNSS occultation for retrieval of water vapor information.

Regarding electron density, the potential of the RO technique has long been demonstrated by studies of ionospheres of other planets, e.g., those of Mars and Venus. First results for the Earth, based on GPS/MET data, promise that the electron density can be gained throughout the ionosphere up to near the LEO orbit height at the 1% accuracy level. This, together with the global coverage potential of the technique, can open a new era for ionospheric remote sensing of unprecedented resolution and quality.

FUTURE POTENTIAL OF GNSS OCEAN REFLECTED SIGNALS

The Global Navigation Satellite System (GNSS, presently GPS/GLONASS) enables beside active limb sounding of the Earth's atmosphere and ionosphere by placing GNSS receivers into Low Earth Orbits (LEO) and employing the radio-occultation (RO) technique (as shown before) also the future potential of employing the radio-reflection (RR) technique by using ocean reflected GNSS radio signals can be investigated within EGOPS. As a first development step in this direction EGOPS V3.0 allows to study all geometrical aspects of RR and allow to investigate and optimize reflection event coverage and statistics.

The RR method bears great utility for fields like operational meteorology, climate monitoring and modelling, due to its potential to globally, and under practically all weather conditions, yield virtually bias-free information on ocean surface wind speed patterns and wave heights with quite good resolution (this could be already demonstrated with GNSS receivers on board of research aircraft). Nevertheless some major improvements of this radio signal detectors are necessary for successful employment of this GNSS RR signal receivers onboard LEO satellites (especially the sensitivity must be stretched to the technical limits because the received signal strengths due to the not optimal radio reflection characteristics of the rough ocean surface are only a very small fraction compared to the GNSS signal strength available for the RO technique). Nevertheless enhancing EGOPS to such applications is a quite useful addition and will make the package even broader useful for future GNSS-related Earth Observation Missions.

REFERENCES FOR DEEPENING THE UNDERSTANDING OF GNSS OCCULTATION

The brief outline above can be considered drawn from a series of excellent references on GNSS occultation science and technology. For the convenience of further interested EGOPS User, a small expert's selection of these (which always reflects subjective judgement of course) of these is given below. References within the more recent of these references readily lead to further original work dealing in depth with specific aspects of the field.

- Overviews for beginners in the field:

Kursinski, E.R., Monitoring the Earth's Atmosphere with GPS, GPS World, Mar'94 issue, 50-54, 1994.

Kirchengast, G., and H.P. Ladreiter, The potential of the radio-occultation technique based on GPS/GLONASS signals for determining fundamental atmospheric parameters (in German), Kleinheub. Ber., 39, 677-686, 1996.

Silvestrin, P., and P. Ingmann, Radio occultation observations using Global Navigation Satellite System signals - A new tool for exploring the atmosphere, Earth Obs. Quarterly, 54, 15-18, 1997. (Also WWW-online at http://esapub.esrin.esa.it/eoq/eoq54.htm)

- A few "keynotes" of "historical" interest:

Fjeldbo, G., and V.R. Eshleman, The bistatic radar-occultation method for the study of planetary atmospheres, J. Geophys. Res., 70, 3217-3225, 1965.

Fjeldbo, G., A.J. Kliore, and V.R, Eshleman, The neutral atmosphere of Venus as studied with the Mariner V radio occultation experiments, Astron. J., 76, 123-140, 1971.

Gurvich, A.S., and T.G. Krasilnikova, Navigation satellites for radio sensing of the Earth's atmosphere, Sov. J. Rem. Sensing, 7, 1124-1131, 1990 (Russian original published 1987).

- A few works being both review-like and deeper-going:

Hoeg, P., et al., Derivation of atmospheric properties using a radio-occultation technique, ESA Final Report (ESTEC Contr.No. 11024/94/NL/CN), also DMI Scientific Report 95-4 (ISBN 87-7478-331-9), 208p., 1995.

Kursinski, E.R., et al., Observing Earth's atmosphere with radio occultation measurements using the Global Positioning System, J. Geophys. Res., 102, 23,429-23,465, 1997.

- And a few recent works on performance demonstration/validation:

Ware, R., et al., GPS sounding of the atmosphere from Low Earth Orbit: Preliminary results, Bull. Amer. Met. Soc., 77, 19-40, 1996.

Kursinski, E.R., et al., Initial results of radio occultation of the Earth's atmosphere using the Global Positioning System, Science, 271 (Feb'96), 1107-1110, 1996.

Rocken, C., et al., Analysis and validation of GPS/MET data in the neutral atmosphere, J. Geophys. Res., 103, in press, 1998.

Steiner, A.K., G. Kirchengast, and H.P. Ladreiter, Inversion, error analysis, and validation of GPS/MET occultation data, Ann. Geophys., submitted, 1998.

- Some European GNSS occultation mission planning documents:

ESA (1996), Earth Explorer candidate mission report for assessment, Atmospheric Profiling mission, ESA Spec. Publ., SP-1196(7), 58p., ESA/ESTEC, Noordwijk, The Netherlands, 1996.

GRAS-SAG (1997), GNSS receiver for atmospheric sounding - Science advisory group report, The GRAS instrument on MetOp (Version 1), ESA/EUMETSAT publication, 38p., available, e.g., at ESA/ESTEC, Noordwijk, The Netherlands, 1997.

- Finally, some books to browse for getting acquainted with GNSS:

Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins, GPS - Theory and Practice, Springer-Verlag, Vienna, 1994.

Parkinson, B.W., and J.J. Spilker Jr. (Ed.), Global Positioning System: Theory and Applications (2 volumes), Progress in astronautics and aeronautics series (Vol.163, 763p., and Vol.164, 643p.), Am.Inst.Aeron.Astron. (AIAA) Publ., Washington, D.C., U.S.A., 1996.

7.5.2 What can EGOPS do for me?

MAIN OBJECTIVES AND CAPABILITIES OF EGOPS

Having in view the scientific and technical background of GNSS occultation science (cf. the "EGOPS explained... EGOPS Background" Help text), the overall objective of EGOPS is effective treatment of as many as possible relevant aspects of GNSS occultation by an integrated, flexible, and user-friendly tool open for continuous improvements.

In this spirit, EGOPS is capable of end-to-end simulation of the GNSS-based radio-occultation technique and of processing of real occultation data (GPS/MET data in case of EGOPS V4.0).

More specifically, the major aims and capabilities of EGOPS are

1) Mission analysis and planning for GNSS (GPS/GLONASS) receivers at LEO satellites (geometry/"shape" of events, coverage, statistics for given GNSS/LEO/ground-station constellations) for occultation or reflection events. [Consult the "Help on Task - Help on Mission Analysis/Planning" entry of the "Help" menu for more information.]

2) Simulation of occultation observations, i.e., forward modeling of GNSS

signal propagation through the atmosphere/ionosphere system plus effects of the observing system, to obtain quasi-realistic observables (with excess phase and amplitude observables as the primary ones). A new EGOPS4 feature is the possibility to process airborne occultations (GNSS receivers onboard aircraft instead of LEOs) within the Forward Modeling tool.
[Consult the "Help on Task - Help on Forward Modeling, Help on Observation System Modeling" entries of the "Help" menu for more information.]

3) Processing of simulated or observed occultation data, i.e., inversion from excess phases and amplitudes, typically via dual frequency Doppler shift and bending angle data, to atmospheric/ionospheric profiles (EGOPS V4.0 including neutral atmospheric profiles of refractivity, density, pressure, temperature, water vapor [pressure], and specific humidity, and ionospheric profiles of total electron content, ionospheric refractivity, and electron density), as well as computation of various data product quality statistics.
[Consult the "Help on Task - Help on Occ. Data Inv./Retrieval" entry of the "Help" menu for more information.]

For conveniently conveying to the User the results of EGOPS-based studies in the fields addressed by the above three objectives, EGOPS has integrated powerful visualization and validation functionality. It allows the User to effectively interpret any study-related processing results immediately in a user-friendly window-based working environment.
[Consult the "Help on Visualize/Validate" Help text entries for more information.]

7.5.3 EGOPS Concept and Structure

EGOPS CONCEPT

The EGOPS objectives state that EGOPS should be capable of quasi-realistic end-to-end simulation of the GNSS-based radio-occultation (GNSS-RO) technique including mission analysis/planning for GNSS receivers in Low Earth Orbit (LEO), simulation of GNSS-RO observables, and processing of such simulated, and observed RO data, towards atmospheric profiles. For EGOPS V3.0 this concept was enlarged to include also geometry simulations of the GNSS-based radio-reflection (GNSS-RR) technique and offers as additional feature for RO data simulation and processing of ionospheric profiles. As major add on for EGOPS V4.0 it is now possible to do mission analysis/planning and simulation of GNSS-RO observables for GNSS receivers installed on board aircraft (called airborne occultations). In addition, post-processing for different types of useful statistical information is required (e.g., occultation or reflection event coverage statistics or statistics for quantifying the quality of retrieval products), and powerful visualization/validation capability shall be integrated.
[See the "EGOPS explained... EGOPS Background, What can EGOPS do for me?" entries of the "Help" menu for more information on the objectives and rationale of EGOPS.]

In order to be able to fully respond to these objectives, the fundamental conceptual idea behind EGOPS is to follow a most general layout: to mimic all components and processes relevant to the GNSS-RO technique in the "real world" as good as possible in the simulator's "model world".

In other words, in order to allow for quasi-realistic simulations of RO observables, all the GNSS-RO ingredients in the "real world" for arriving at the observables are mimicked in the "model world". In this spirit, the EGOPS concept includes as main components a "GNSS Signal Simulator" mimicking the GNSS signals, an "Atmosphere/Ionosphere System Simulator" mimicking the atmosphere/ionosphere system, a "Geometry Simulator" mimicking the GNSS occultation (reflection) system geometry, and a "Receiving System Simulator" mimicking the receiving system. The overall process involving all these systems is the propagation of the GNSS-transmitted signals through the atmosphere/ionosphere towards the GNSS receivers in LEO which is mimicked by a "Signal Propagation Simulator".

This "object-oriented" concept makes alternative options and upgrades of the various components/processes extremely flexible since the "system boundaries" are very generically chosen in the concept.

In the same spirit, the data processing concept for retrieving atmospheric/ ionospheric data products from these observables, always a "model world" enterprise of course, includes a structured "Inversion/Retrieval Toolkit", naturally divided internally into generic processing steps (processes) and data pools (components). Again high flexibility exists for parallel alter- native options as well as upgrades of various components/processes.

The "Visualization/Validation System" concept, having integrated useful post-processing capability as well as capability for extracting "ground truth" information from the atmosphere/ionosphere system from internal or external sources, includes again a structured-toolkit layout of several flexible components for convenient interactive visual analysis and interpretation of EGOPS study results.

The modular structure of the EGOPS software as described in the section below, directly reflects this generic concept in that the actual design and partitioning into program modules of software observes the generic natural boundaries prescribed by the concept. In this way, a flexible software tool is obtained which can well cope with the objectives outlined and which is truly open for continuous improvements.

[Note: The "EGOPS Concept and Structure" section in the "EGOPS Software User Manual" contains a Figure nicely illustrating graphically the concept outlined above.]

EGOPS STRUCTURE

EGOPS is implemented following a modular structure which directly derives from the concept described above and which is complaint with the main objectives of the software. The latter is particularly important at the EGOPS User I/F level to make it straightforward for the User to address a topic within a specific objective (e.g., if you want to perform some specific mission planning with EGOPS - knowing that the tool involves such capability - you like to have a User I/F structure more or less immediately showing you how to address this objective with the tool).

The description of the EGOPS structure that follows is organized into the following subsections:

*** Modular View of EGOPS

*** Main Design Guidelines

*-- Fulfilment of the Main Objectives of EGOPS

*-- ReFlexPortEx - Reliability, Flexibility, Portability, Extendability

*-- Use of Two Programming Languages (IDL/FORTRAN)

*** File Structure Behind EGOPS

*** Modular View of EGOPS

The structural design of the EGOPS software can be best illustrated in terms of considering how the software is partitioned into high-level modules, i.e., in taking an implementation-oriented modular view of the entire tool. Such an implementation-oriented modular view is briefly described in this subsection, together with giving, where deemed appropriate, some rationale and explanation of different modular functions.

[Note: The "EGOPS Concept and Structure" section in the "EGOPS Software User Manual" contains, in addition to the description, also a Figure nicely illustrating graphically this implementation-oriented modular view.]

The entire software can be understood to be composed of a series of high-level modules, which are partly integrated into so-called Systems, and there exist specific data flows between the modules/Systems.

The modular structure contains at highest level a "Project Selection" and a "Help Provision" module.

The rationale behind "Project Selection" is the following: EGOPS work and related data are organized in "projects" (handled at User I/F level via a "Project" menu), which provide the user with a convenient means to group the computations of a series of simulation scenarios, which for some logical reason belong to each other, into a common folder.
A "Project" within EGOPS is thus a group of simulation and visualization/ validation activities whose data (input/output of simulation scenarios) is separated from that of other projects.
In fact the separation of the projects is physically reflected in the EGOPS file structure on disk, where each project's data are gathered below a /<project-id> subdirectory which is created as subdirectory of the root directory /EGOPS during project launch.
(See, for more information on EGOPS Projects, the "Help on Project - About Projects" entry of the "Help" menu and the subsection on "File structure" below.)

The rationale behind on-line "Help Provision" for all EGOPS functions, both at main User I/F level and at sub-levels (window-based help within each pop-up User I/F window), is obvious: It is more convenient to work if one needs not necessarily refer to written documentation in course of using a software.
(See the "Help on Help" entries of the "Help" menu for more information.)

Furthermore, the modular structure contains a bulk of four modules named "...Input" and a bulk of five "Systems". Each of the first four "Systems" has an associated "Input" module. These first four "Systems", the "Mission Analysis/Planning System", the "Forward Modeling System", the "Observation System Modeling System", and the "Inversion/Retrieval System", constitute the computational kernel of EGOPS in that these are actually performing the end-to-end occultation simulations whilst the last "System", the "Visualization/Validation System", is devoted to post-processing and validation processing and especially to conveying the results produced by the four computational "Systems" in convenient form to the User.

The possible data flows among the modules/Systems reflect the natural hierarchy of the physics the software deals with (as further detailed below within the following subsections and also well seen in the graphical illustration of the modular view in the "EGOPS Software User Manual").

*** Main Design Guidelines

The rationale for implementing this specific modular design may be best understood if discussed with reference to the three main guidelines which have been baselined by the system developers as the main drivers of EGOPS development. These were

1) Fulfilment of the main objectives of EGOPS, as already noted above.
   (See the "EGOPS explained... What can EGOPS do for me?" entry of the "Help" menu for more information on these objectives.)

2) ReFlexPortEx, a convenient acronym for expressing the particular attention paid to Reliability, Flexibility, Portability, and Extendability.

3) The use of two programming languages (IDL/FORTRAN), mainly required to reach both the aim to include also already existing software (FORTRAN) and the aim to furnish a modern User I/F (IDL).

Each of these three main guidelines is discussed in the following subsections.

*-- Fulfilment of the Main Objectives of EGOPS

The appropriate fulfilment of the main objectives of EGOPS is certainly of utmost importance. Thus mission analysis/planning, RO (RR) observation simulations, and RO (RR) data processing need to form the computational core of EGOPS. Complementing this, integrated visualization/validation capability, including post-processing, is needed.

According to the EGOPS concept, a natural hierarchical partitioning to serve all these needs in an end-to-end framework, which was adopted for EGOPS, is to partition the computational core, at highest level, into mission analysis/planning, forward modelling, observation system modelling, and inversion/retrieval. Structured visualization and validation capability, with integrated post-processing functions, was added supporting the analysis and interpretation of studies performed with each of the computational parts.

In fact this partitioning just leads to what is called Systems (and Inputs to Systems for the computational parts) within the modular structure described above. The high-level structural components shall be briefly further explained below.

-> Mission Analysis/Planning (MAnPl): This component comprises the analysis and planning of single LEO satellites and LEO constellations carrying GNSS occultation (reflection) receivers, including antennae field-of-view planning and analysis and visibility analysis w.r.t. ground stations, for assessing, investigating, and optimizing occultation event coverage and related relevant statistics. This will either be done "stand-alone" or as the first stage for planning and selection of useful occultation events then exploited for observation simulations.

Main modular parts for mission analysis and planning are simulation of occultation (reflection) geometries ("Geometry Simulator") and computation of the visibility of satellites from ground fiducial or tracking sites ("Visibility Information Generator"). (Cf. the "Modular View" Figure in the "Software User Manual".)

[For more information on Mission Analysis/Planning, and the associated visualization capabilities within EGOPS, see the "Help on Task - Help on Mission Analysis/Planning" entry of the "Help" menu.]

-> Forward Modeling (FoMod): In case of interest in observation simulations, this is the natural stage following some planning for occultation events with desired properties (e.g., events occurring in a geographic region of interest, etc.).

Forward Modeling (FoMod), together with subsequent Observation System Modeling (OSMod), performs quasi-realistic simulation of observables, and related required variables, of the GNSS occultation technique. The main observables are time-tagged phase and amplitude measurements, obtained in real world by tracking occulted GNSS signals with a LEO platform-mounted GNSS receiver for atmospheric sounding (GRAS) during their set/rise through the atmosphere imposed by the relative orbital motion of the GNSS and LEO satellites.

Forward Modeling itself denotes the simulation of GNSS signal propagation through the atmosphere/ionosphere system given the orbital motions of the GNSS and LEO satellites. In EGOPS V4.0 its also possible to simulate so called airborne occultations, whereas the GNSS receiver is placed on an aircraft instead of a LEO satellite. It results in "ideal" signals which contain the effects of the atmosphere/ionosphere media only. Thus FoMod results allow to inspect the environmental influence alone.

Main modular parts for forward modelling are GNSS signal simulation ("GNSS Signal Simulator"), orbit arcs simulation for GNSS and LEO for the period of the occultation events treated ("Orbit Arcs Simulator"), simulation of the atmosphere/ionosphere system ("Environment Simulator"), and propagation simulation (ray tracing) for the GNSS-LEO link ("Signal Propagation Simulator"). The numerical code for airborne occultations is written in IDL (in contrast to most of the other important modules) and concentrated in tfomod_tools.pro . (Cf. the "Modular View" Figure in the "Software User Manual".)

[For more information on Forward Modeling, and the associated visualization capabilities within EGOPS, see the "Help on Task - Help on Forward Modeling" entry of the "Help" menu.]

-> Observation System Modeling (OSMod): This next stage, following FoMod and using its "ideal" signal and orbit arcs output data, denotes the superposition of all sorts of relevant physical and technical influences of the observation system (antenna, receiver, platform, fiducial sites) on the "ideal" signal (phase and amplitude data) arriving at the receiving antenna, and on the "ideal" orbit data (GNSS and LEO positions and velocities). In fact these "ideal" data are the output of Forward Modeling, a necessary prerequisite to be performed before Observation System Modeling can be done.

The most relevant observation system effects to be modeled include precise orbit determination (POD) errors, the antennae gain pattern, receiver noise, local multipath (due to the platform structure in the vicinity of the antenna), and differencing treatment/clocks precision.

Main modular parts for observation system modelling are precise orbit determination (POD) error simulation ("POD Error Simulator"), antennae pattern simulation ("Antennae Simulator"), and receiving system simulation ("Receiving System Simulator"), the latter including modelling of receiver performance, local multipath, and differencing treatment/clocks.
(Cf. the "Modular View" Figure in the "Software User Manual".)

[For more information on Observation System Modeling, and the associated visualization capabilities within EGOPS, see the "Help on Task - Help on Observation System Modeling" entry of the "Help" menu.]

-> Occ. Data Inversion/Retrieval (InRet): Inversion/Retrieval processing is the last computation stage of end-to-end simulations. In addition, besides processing of simulated data, it is applicable in an identical manner also to observed data. More specifically, the InRet function performs the processing of simulated or observed phase and amplitude data (supplemented by the necessary geometrical information) typically via Doppler shifts and bending angles down to quasi-vertical atmospheric profiles of refractivity, density, pressure, temperature, and humidity. EGOPS also allows to process ionosphere profiles of total electron content, Doppler shift, bending, refractivity, and electron density.

This processing chain typically requires, sequentially, tools for ionospheric correction and conversion of the "raw" excess phase observables to neutral-atmospheric bending angle profiles, for inversion of bending angle profiles into refractivity profiles ("Inverse Abel Transform"), and for finally retrieving the atmospheric variables (e.g., temperature) from refractivity. The air (in the troposphere) may be considered either dry or moist in the last stage of this processing chain.

Main modular parts are for occultation data inversion/retrieval are, based on the processing chain outlined, an "Ionospheric Correction and Bending Angle Retrieval Toolkit", a "Refractivity Profiles Retrieval Toolkit", and an "Atmospheric Profiles Retrieval" Toolkit".
(Cf. the "Modular View" Figure in the "Software User Manual".)

[For more information on Occ. Data Inversion/Retrieval, and the associated visualization capabilities within EGOPS, see the "Help on Task - Help on Occ. Data Inversion/Retrieval" entry of the "Help" menu.]

-> User I/F and post-processing, visualization and validation:
From the point of view of the EGOPS User I/F, there is a "Task" menu available at main level, which furnishes four generic Task options, i.e., menu entries. These correspond directly to the four main computational parts (MAnPl, FoMod, OSMod, and InRet) outlined above. Thus the simulator fully reflects the natural hierarchy of the simulation problem and the results of one task the User performs (e.g., a MAnPl task) are typically part of the input of the next-stage task (e.g., a FoMod task). (Briefly on what EGOPS "tasks" are: these are the individual computational scenarios comprised by an EGOPS Project. A task corresponds to computing a specific scenario by employing one of the four generic Task options. - For more information on "tasks", see the "Help on Task - About Tasks" entry of the "Help" menu.)

The link between the "Task" menu entries and the computational parts is provided by the four modules "MAnPl Input", "FoMod Input", "OSMod Input", and "InRet Input", which correspond to four User I/F window interfaces, each one accessed by a specific "Task" menu entry. These Input modules directly supply the User input data to their respective computational System. (Cf. the "Modular View" Figure in the "Software User Manual".)

After any stage, post-processing and visualization/validation is possible for the results so far computed, by employing the EGOPS "Visualization/ Validation System", which corresponds, at User I/F level, to the "Visualize/Validate" menu. The modular parts of this System are "MAnPl Profiles", "Geographic Maps", "Profiles", "Volume Data", and "Data Animation" (Note: The latter two modules compute and visualize atmosphere/ionosphere field variables rather than computational System results). These modules, in turn, correspond at User I/F level to five window interfaces, each one accessed by a specific "Visualize/Validate" menu entry. (Cf. the "Modular View" Figure in the "Software User Manual".) [For more information on Visualization/Validation within EGOPS, see the "Help on Visualize/Validate" entries of the "Help" menu.]

*-- ReFlexPortEx - Reliability, Flexibility, Portability, Extendability

ReFlexPortEx is expressing, as a generic acronym, key quality requirements which an implementation design should try to fulfil well. These requirements were carefully observed for EGOPS as briefly detailed below.

-> Reliability: Reliability is taken care of by the strict modular design making EGOPS a "lean" sequential system robust in operation. The underlying file structure (cf. the subsection below) is strictly mirroring the modular implementation supporting reliable use and safety of already produced EGOPS data. Each computational routine within the modular structure takes a clearly defined role in a sequential control and data flow; thus in case of error (i.e., abnormal termination) only the results produced by a single routine currently running get lost, all other existing information is conserved and fully usable after EGOPS restart or resumption of operations (cf. the error handling information accessible by the "EGOPS explained... EGOPS SetUp & Use Notes" entry of the "Help" menu).

-> Flexibility: Flexibility is provided to the User by the partitioning of EGOPS into four stages directly reflecting the natural parts of the GNSS-RO (RR) technique as described in the above subsection. The control and data flow is structured so that after any of these stages the User can, for the results already produced, post-process, visualize/validate, print and protocol the results. For instance, a specific EGOPS-based study may well be solved already at an intermediate stage so that the User wants to stop simulations with the data products so far obtained (e.g., doing mission analysis/planning only).

The User can furthermore, after any stage, temporarily or permanently: Change to another project to continue work there just at the point where it was stopped, suspend or stop work to resume it later (or let it be resumed by another User), etc.

For each of the four generic Task options, the User is furnished a specific single input window (e.g., MAnPl Input I/F window) providing for effective input of all necessary parameters for any desired individual computation scenario (task), and including the option of loading already existing tasks. (Note: within a project often scenarios are analyzed differing only in one or very few parameters in their input. In this case the respective individual task input data are very similar and loading of existing task input data can immediately provide a very good default for a next task.)

For more advanced Users, the transparent file structure (see subsection below) and file contents (formatted ASCII/80 character width format obeyed by all files) provides considerable interfacing flexibility in addition to the EGOPS User I/F (e.g., interfacing in parallel by a file manager or editor application or interfacing data files by User-produced non-EGOPS software for purposes like external post-processing or visualization). Furthermore, at various points the informed User (with source-code license) can, with modest effort, link his/her own routines to EGOPS, which are then directly accessible from within the EGOPS User I/F. (In EGOPS V4.0(3.1), such a "slot" is directly prepared for inclusion of User-supplied atmospheric models. - The usratm.SampleFile in the /prog/FORprog directory of the EGOPS installation gives more information.)

-> Portability: EGOPS is an IDL/FORTRAN software product with the modules produced under IDL strictly partitioned from those under FORTRAN. All IDL routines strictly obey the IDL 5.4 standard, all FORTRAN routines the F95/F90 standard. This standardization secures independency from specific IDL/FORTRAN installations. All computational Systems (MAnPl System, FoMod System, OSMod System, and InRet System) are purely written in FORTRAN, the User I/F and the Visualization/Validation System are purely written in IDL (the latter with one exception, a "Reference data provider" program, which interfaces the atmospheric/ionospheric models of the computational Systems and is therefore written in FORTRAN). We note that besides portability this significantly eases software maintainability as this partitioning is coherent with the natural partitioning of the simulation problem as discussed above.

The data exchange of all data, from input data to result data, within the IDL and FORTRAN part of EGOPS is entirely performed via files (see the subsection below). This completely avoids any call of FORTRAN within IDL and vice versa and secures platform independency which would be lost with any other solution. With respect to the usage of operating system commands within EGOPS (changing/ generating/naming directories, files, etc.), the generic Unix-standard is strictly obeyed so that any dependence on a specific Unix dialect, implementation or platform is avoided.

-> Extendability: The modular design of EGOPS with its "natural" interfaces makes the software an open system extendable both in its basic scope and its depth. The upgrading from EGOPS3 to EGOPS4 was an impressive confirmation of this extendability. A most important aspect here is that any module may be replaced or complemented by a "better" one (another GNSS system, another GNSS frequency, another atmospheric model, another signal propagation simulator, another bending angle inversion tool, etc.). A second aspect is that modules with entirely new functions can be added (e.g., an "   ...   inversion" tool to the InRet System, an "Event Geometry" visualization tool to the Vis/Val System, etc.). A third aspect is that new computational Systems can be added (e.g., an Atmospheric Imaging (AtmIm) System, which would be placed as successor of the InRet system). Both the design of the User I/F and Visualization/ Validation System (IDL) as well as the design of the computational Systems (FORTRAN) are structured with respect to their control and data flow in a way to ensure such extendability.

With respect limits to extendability harder to overcome, it should be noted that generally biggest upgrade efforts will occur for extensions by modules, which require input information currently not yet provided by the data flow to the place the new module is supposed to fill (e.g., as an arbitrary example, extension by a novel improved ionospheric correction and bending angle retrieval module, which invokes auxiliary ionospheric occultation data acquired just before/after the setting/rising atmospheric occultation).

*-- Use of Two Programming Languages (IDL/FORTRAN)

The use of two programming languages was constrained by the facts

(i) that the EGOPS User Interface and Visualization functionality should be user-friendly modern standard (window-driven, point-and-click, effective visualization), and

(ii) that several computational routines existed in FORTRAN-77, which were worth including in an adapted form within EGOPS.

Constraint (i) called for a powerful high-level language. IDL (Interactive Data Language) was selected, which is widely in use in the engineering/ scientific world for interactive visual analysis applications as EGOPS can be considered to be one.

Constraint (ii) called for use of the FORTRAN standard for the computational modules. The FORTRAN-95/90 standard was selected, which is downward compatible to F77, which is widely in use in the engineering/scientific world for mathematical routines. The choice of F90, and adjustment of all existing F77 routines to this standard, ensures that newly developed EGOPS software can follow the state-of-the-art FORTRAN standard, while all existing F77 software is still readily included (generally needing minor adjustments only).

For the sake of a clear design and high ReFlexPortEx, the partitioning between the IDL and FORTRAN parts of EGOPS is strict. The four computational Systems are written in FORTRAN, the User Interface and the Visualization/Validation System are written in IDL (except the "Reference data provider" program, as mentioned above).

Control is exercised by IDL and the interfacing between IDL and FORTRAN is as follows.

An IDL Input module (e.g., the "MAnPl Input" User I/F after commanding "Save & Compute") generates a standardized input file for its respective computational System and then kicks off execution of this System. The System (FORTRAN), more precisely speaking its main program, reads the complete set of input data from the standardized input file and then performs the computations for the given scenario task according to the input. In parallel, it flags the status of the computations to a standardized information/error message file (to allow robust error handling). As major improvement for EGOPS V4.0 its now possible (for most cases) to use the EGOPS batch processing mode for time consuming calculations (especially valuable for forward model simulations) instead of the standard online calculations. Therefore the user simultaneously can run several EGOPS jobs (on a multi processor machine) and use in the same timeframe the EGOPS Visualization/Validation System to monitor earlier results.

Result files are then produced by specific modules of the System. (Note: In the "Modular View" Figure of the "Software User Manual" the result file data-flows are indicated by the vertical arrows from one computational System to the next and by the arrows, at the right part of the Figure, towards the Visualization/Validation System.) After completing its computations, the System passes a success information to the standardized message file.

Having resumed back control, the IDL interface reads the standardized message file and takes action as necessary (e.g., performs its error handling in case no successful completion is reported by the System). After this point, computations for the particular task are completed and the User can proceed further as desired with any other task, visualization, etc.

Each IDL/FORTRAN interfacing within EGOPS is strictly implemented as described, for ensuring high ReFlexPortEx.

*** File Structure Behind EGOPS

[Prerequisite note: The "Software User Manual" contains a Figure graphically illustrating the EGOPS file structure. The description below heavily refers to this Figure. In case imagination not suffices to get the key points when reading this text On-line under "EGOPS explained... EGOPS Concept and Structure", the User should either have available the Figure in parallel, or, (recommended to informed Users) should inspect the file structure in parallel within a file manager application.]

All EGOPS programs and data are placed under a root directory named /EGOPS during the installation process. EGOPS.RunMe is the root directory command file, also created during installation, which is executed to start EGOPS. The other EGOPS intrinsic files in the root directory are EGOPS.FAQs (accessed via the "EGOPS explained... EGOPS Users Corner FAQs" entry of the "Help" menu), EGOPS.ReadMe (accessed via the Help entry given in the note below), and EGOPS.ini (a file prepared to furnish miscellaneous external definitions to EGOPS). EGOPS.ReadMe and EGOPS.FAQs are files, which may be irregularly up-dated also between new EGOPS releases.
(Note: The non-advanced user needs not know anything else about the EGOPS file structure but this fact that EGOPS is started by executing EGOPS.RunMe in the

EGOPS root directory. - See the "EGOPS explained... EGOPS SetUp & Use Notes" entry of the "Help" menu for further information on installation-related questions.)

Below the root directory, the file structure consists of two main parts. One part holds the project-independent data of EGOPS (illustrated in the lower left part of the "EGOPS File Structure" Figure), the other part holds the project-related data, which are partitioned according to the four generic Task options available (MAnPl, FoMod, OSMod, InRet). Furthermore, a subdirectory /PSfiles appears, which holds all PostScript files the User prepares within the project for printer output.

There is one project which is integral to EGOPS, named "EGOPSProject", which is associated with the /EGOPSProject subdirectory in the file structure.
It belongs to the basic installation package, and is the default project of EGOPS which contains the minimal default information necessary to operate the simulation and visualization/validation functionality.
(Each time a new project is started, this minimal default information is carried over from the "EGOPSProject" to the new project's directories.
- See the "Help on Project - About Projects" entry of the "Help" menu for more information on what an EGOPS project is.)

-> Project-independent part of the file structure:

The file structure of the project-independent part consists of the seven subdirectories: /prog (with an appropriate substructure), /antpattern, /projshelf, /groundst, /orbitelem, /genPSfiles, and /referdata (with an appropriate substructure). Under subdirectory /prog the EGOPS program package resides (/prog/txtfiles contains the Help texts, the exact contents of the /prog/IDLprog and /prog/FORprog subdirectories depending on the license type; cf. EGOPS.ReadMe). /antpattern holds two different antenna pattern characteristics files, /projshelf contains all stored EGOPS projects (in compressed form as *.tar.gz file), /groundst holds the ground-station coordinates/specs files (*.gst files, see also the file gst.Help in this directory). /orbitelem holds the orbit element files for the GNSS/LEO satellites (*.tle files, see also the file tle.Help in this directory). /genPSfiles holds the created PS files, which are not related to a specific project. Under /referdata reference "gridbox" data files of variables of atmosphere/ionosphere models reside (2D geographical data sets under /referdata/mapsdata and 3D volume data sets under /referdata/volumdata, respectively, available to be visualized with the "Volume Data" and "Data Animation" functions of EGOPS).

-> Project-related part of the file structure:

Concerning the project-related part, each User-specified project, as soon as launched via the EGOPS User I/F by assigning a Project-id (name), is allocated its own directory (directories ../<project-id1>/, ../<project-id2>/, etc.). (Note that the /EGOPSProject directory always exists.) A project directory contains all the information related to it in subdirectories named according to the four generic Task options available (subdirectories /MAnPl, /FoMod, /OSMod, and /InRet). In any project directory a <project-id>.log file exists, which the User may utilize as "notebook" to protocol information on the project. (Note that EGOPSProject.log contains information on its own rationale which must not been touched.) A project can be closed, opened, and renamed at any stage of work without impairing the existing information conserved in its file structure.

The four "Task option" subdirectories contain the respective standardized input files for handling User I/F (IDL) information to the computational Systems (FORTRAN), one unique file for each specific scenario (task) computed by the User and thereby assigned a task-id. These files are the <task-id>.inp files, which exist in the "Task option"-subdirectories (/MAnPl/<task-id.MA1>.inp, /FoMod/<task-id.FM1>.inp, etc.). (Note: For handling information from IDL to FORTRAN, the currently used <task-id>.inp file is always temporarily duplicated by IDL to a file in the EGOPS root directory with frozen filename (MAnPl.inp, FoMod.inp, etc.) which is opened, read, and then deleted by the respective FORTRAN System.)

The "Task option" directories furthermore hold all result files produced by the respective computational Systems as explained below.

-> MAnPl directory:
In case of MAnPl these are, for each individual task performed, a "Simulated Geometry Data" file (/MAnPl/<task-id>.sgd) and, optionally, a "Visibility Data" file (/MAnPl/<task-id>.vis). The /MAnPl directory will also contain all MAnPl "child"-files derived during post-processing for visualization (e.g., histogram data).

-> FoMod directory:
In case of FoMod these are one or more "Simulated Geometry Data" file(s) (/FoMod/<task-id>_<occ-no>.sgd; containing the "ideal" FoMod geometry data) and one or more "Simulated Signal Data" file(s) (/FoMod/<task-id>_<occ-no>.ssd; containing the "ideal" FoMod phase and atmospheric power loss data). One file per simulated occ. event exists. In case of airborne occultations additionally a /FoMod/<task-id>.sgdAPT file containing the airplane trajectory geometry data will be produced (this is the analog of the /MAnPl/<task-id>.sgd file). The number of occ. events depends on the event sample size chosen by the User for the given task. The basic space/time information on the occurrence of the occultation events is taken from a /MAnPl/<task-id>.sgd file prepared by an earlier MAnPl task run (selected during FoMod input). The directory will also contain all FoMod "child"-files which may be derived in course of the visualization/validation processing from the "ideal" signal data.

-> OSMod directory:
In case of OSMod these are one or more "Simulated Geometry Data" file(s) (/OSMod/<task-id>_<occ-no>.sgd; containing the quasi-realistic geometry data) and one or more "Simulated Signal Data" file(s) (/OSMod/<task-id>_<occ-no>.ssd; containing the quasi-realistic excess phase and amplitude data). One file per simulated occ. event per file. The number of occ. events depends on the event sample size chosen by the User for the given task. The basic event samples for superposition of observational effects, both *.sgd and *.ssd files, are taken from /FoMod/<task-id>_<occ-no>.sgd(.ssd) file samples prepared by an earlier FoMod task run (selected during OSMod input). The directory will also contain all OSMod "child"-files which may be derived in course of the visualization/ validation processing from the quasi-realistic signal data.

-> InRet directory:
In case of InRet there are subdirectories for simulated data products (/SimData) and, for EGOPS V4.0(3.1), observed GPS/MET data products (/GMData) both with identical substructure. (Note: Other observed data can be included in the file structure in full analogy to GPS/MET data, e.g., Oersted/GPS data would get a directory /OGData.)

The substructure provides, for both simulated and observed RO data processing, directories tailored to the seven derived basic data products: Doppler shifts (/Dopp), bending angles (/bend), refractivities (/refr), densities (/dens), pressures (/pres), temperatures (/temp), water vapor (/wvap), total electron content (/Itec). These contain the respective result files, one file per occ. event, from the InRet computational system. The basic result profiles are contained in <task-id>_<occ-no>.<Par> files, where <Par> denotes one of "Dopp", "IDop", "Bend", "IBen", "Refr", "IRef", "Dens", "IDen", "Pres", "Temp", "Wvap", "Humi", "Itec"; "Wvap" (water vapor pressure) and "Humi" (specific humidity) which are both contained in the /wvap directory. The respective directories contain as well all the "child"-files, which may be derived from the basic result profiles of the parameters in course of the visualization/validation process.

For observed data processing, where the original data (profiles of RO observables) always reside in a file structure external to EGOPS as the "EGOPS File Structure" Figure indicates, an additional subdirectory /PhAm is furnished (for GPS/MET data an /InRet/GMData/PhAm directory). This holds, as basic result files, the observed geometry and signal data (files /PhAm/<task-id>_<occ-no>.ogd and /PhAm/<task-id>_<occ-no>.osd, respectively) in the EGOPS-internal geometry and signal data format. Also, the "child"-files of the observed phases and amplitudes find their place here.

The basic data for computation are taken by the InRet system, in case of simulated data, from /OSMod/<task-id>_<occ-no>.sgd(.ssd) file samples

prepared by an earlier OSMod task run (selected during InRet input).
In case observed GPS/MET data are processed, the basic data (UCAR/POCC level-2 data) are taken from the respective GPS/MET data directory assigned by the User (during InRet input).

Comparing, in the "Software User Manual", the "EGOPS File Structure" Figure with the "Modular View" Figure indicates that the design of the directory and file structure was developed under strict guidance by the implementation design, i.e., the modular structure of the software, and its control and data flow. Thus the file structure can be considered to support well the efforts for high usefulness and ReFlexPortEx of the whole EGOPS software package.

7.5.4 Written Documentation about EGOPS

SOFTWARE USER MANUAL

The primary source for written documentation on EGOPS is the

EGOPS Software User Manual

which is received, together with the software package, by every User who acquires a version of EGOPS.

The User Manual essentially contains all information of the On-line Help text available within EGOPS plus, in addition, a documentation of example simulations and their results which were worked out within two exemplary EGOPS Projects. These example projects may be quite instructive to more or less recent Users who can probably gain much from seeing demonstrated many of the functions of EGOPS in a practical work context.

BACKGROUND DOCUMENTATION

For learning about the functionality furnished by EGOPS and for getting an overview on its background, rationale, requirements, and implementation the following reports are useful:

Kirchengast, G., End-to-end GNSS Occultation Performance Simulator functionality definition, Techn. Rep. for ESA/ESTEC No. 1/'96, 25p., Inst. Meteorol. Geophys., Univ. of Graz, Austria, 1996.

Kirchengast, G., End-to-end GNSS Occultation Performance Simulator overview and exemplary applications, Wissenschaftl. Ber. No. 2/1998, 138p. (PartI-III), Inst. Meteorol. Geophys., Univ. of Graz, Austria, 1998.

A more detailed (and more formal) summary of all requirements of the S/W design is URD and ADD in a User & Software Requirements document which, in turn, formed the basis for the software design described in an Architectural & Detailed Design document.

The latter two technical documents, which provide a rather detailed description of the EGOPS software, are of interest to (expert) Users needing to get very closely acquainted with technical details of the software.

7.5.5 EGOPS SetUp & Use Notes

```
         ==============================================
            EGOPS explained... EGOPS SetUp & Use Notes =
            ==============================================



============================================================
 =
  = EGOPS (End-to-end GNSS Occultation Performance Simulator)
   = version concerned:
    =
     =    EGOPS(R) V4.0, Release#2, March 1, 2002 (EGOPS4.0).
      =      (c) IGAM/UG et al. 1997-2002. - All Rights Reserved.
       =
        ============================================================



These SetUp & Use Notes comprise brief information on the following topics:

   - Contents of the EGOPS Software Package

   - Where to find the EGOPS Installation Guidelines

   - The International EGOPS Maintenance Center (IEMC)


--------------------------------------------------------------------------------


                    ******************************
                    *** EGOPS Software Package ***
                    ******************************


You should have received:

 - A binary compressed archive file named EGOPS<version>-<yyyymmdd>.tar.gz;
   for the current version the name is EGOPSv40-20020301.tar.gz, or
   EGOPSv40rtsun-20020301.tar.gz, or EGOPSv40rtlin-20020301.tar.gz, or
   EGOPSv40rtsgi-20020301.tar.gz, respectively. (Version EGOPS V4.0,
   Release#2, March 1, 2002.)
   This archive file contains the entire EGOPS software package.

 - A binary compressed archive file named EGOPS4_SUM-Issue<n>.tar.gz; for the
   current version the name is EGOPS4_SUM-Issue2.tar.gz.
   This archive file contains the EGOPS, Version 4, Software User Manual in
   form of a pdf file package comprising an overview and a reference manual
   part (EGOPS4_SUM-OV.pdf & EGOPS4_SUM-REF.pdf).

 - An ASCII text file named EGOPS.ReadMe[_v40-20020301], the text you are
   currently reading.


--------------------------------------------------------------------------------


                  *************************************
                  *** EGOPS Installation Guidelines ***
                  *************************************


 Detailed step-by-step EGOPS Installation Guidelines are provided in Section 5
 of the EGOPS Software User Manual - Overview Manual (EGOPS4_SUM-OV.pdf).
 That section also provides Upgrade Notes and helpful Use and Operating Notes.
```

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          ********************************************************
          *** The International EGOPS Maintenance Center (IEMC) ***
          ********************************************************


 The IEMC is a Service Center set up at IGAM/UG as part of a trilateral
 "EGOPS Licensing Agreement" amongst the EGOPS2 developers IGAM/UG, DMI
 (Danish Meteorological Institute, Copenhagen, Denmark), and TERMA (TERMA
 Elektronik A/S, Birkeroed, Denmark).
 Its mission is to provide, at best-effort within available resources,
 maintenance and user support services for the EGOPS2 user community.
 The IEMC continues and enhances this mission with EGOPS3 and EGOPS4.

 For details on the IEMC and its services, please see Appendix C of the
 EGOPS Software User Manual - Overview Manual (EGOPS4_SUM-OV.pdf) or the
 IEMC website noted below.


 The point of contact for all IEMC matters is:

    Gottfried Kirchengast
    Director, International EGOPS Maintenance Center (IEMC)
    Institute for Geophysics, Astrophysics and Meteorology,
    University of Graz
    Universitaetsplatz 5
    A-8010 Graz
    Austria
    Fax: +43-316-380-9825
    E-Mail: iemc.igam@uni-graz.at  or
            gottfried.kirchengast@uni-graz.at
    IEMC Website: http://www.uni-graz.at/igam-iemc

 Feel free to contact the IEMC with whatever relevant information need
 or EGOPS-related problem you have. The IEMC will try to help you
 with advice and in finding a solution.
```

7.5.6 EGOPS Users Corner - FAQs

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=================================================
   EGOPS explained... EGOPS User's Corner - FAQs =
   ================================================


PURPOSE of this User's Corner

A list of questions/answers of general interest and potential help to many
Users of the EGOPS User Community is moderated and maintained by the
International EGOPS Maintenance Center (IEMC) hosted by IGAM/UG.
The questions come from EGOPS Users, the answers are provided by
IGAM/UG's leading EGOPS experts.

Questions can be submitted to the point-of-contact address available
via the "About EGOPS..." entry of the EGOPS "Help" menu.
Please submit only short questions whose answers are likely to be of
general interest. Suggested clarifications to past answers are also
appreciated and will be incorporated as appropriate.

The maintainers of this list of FAQs reserve the right to condense/re-phrase
submitted questions where helpful for best conveying a problem's solution.
The ordering of topics in the list is more or less arbitrary. List updates
are performed irregularly when new significant questions are received
or existing entries rendered inadequate or obsolete.

          ----------------------------------------============
          FAQs - Frequently Asked Questions...  ...and Answers
          ----------------------------------------============

     Current no. of Questions & Answers contained:  1  (Dec 30, 1997)
                                                   tbd (mmm dd, yyyy)

Topics of Questions & Answers (Table of Contents):

Q&A  1: How does EGOPS compare with other similar tools?
Q&A  2: tbd

--------------------------------------------------------------------------------

Q 1: How does EGOPS compare with other software tools offering similar
     functionality for addressing GNSS occultation-related problems?

A 1: We are not aware of any other software which could match EGOPS in its
     functionality, flexibility, and user-friendliness for performing
     GNSS-LEO mission analysis/planning, end-to-end simulations of the
     GNSS-based radio occultation technique, and processing of GNSS
     occultation data. While admitting that we have not conducted a
     thorough worldwide "market" survey, our somewhat immodest guess
     is that EGOPS is the unambiguous no. 1 worldwide. (We welcome to
     be notified on facts which may suggest to us more modesty.)

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Q 2: tbp (to be posed)

A 2: tba (to be answered)

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```

7.5.7 About EGOPS...

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                            E G O P S 4 =
                            ===============


              End-to-end GNSS Occultation Performance Simulator
                 Version 4.0, Release#2, March 1, 2002


           EGOPS(R) V4.0 (EGOPS4) was developed as a major upgrade
                 of EGOPS3 (reference information appended)
                       by an International Consortium
                              involving Teams at

           Institute for Geophysics, Astrophysics, and Meteorology
                   University of Graz (IGAM/UG), Austria

                   Austrian Aerospace GmbH (AAE), Austria

                     Meteorological Office (MetO), U.K.

                  European Space Agency (ESA), Netherlands


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--------------------------------------------------------------------------------

         IGAM/UG Team: G. Kirchengast (Leader of EGOPS development),
               J. Ramsauer, W. Poetzi, J. Fritzer, A. Veronig,
                     M. Gorbunov (IAP Moscow), A. Steiner

                 AAE Team: H. Reichinger, F. Zangerl, M. Sust

                       MetO Team: S. Healy, D. Offiler

                      ESA Team: P. Silvestrin, A. Tobias

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                  Developed with financial support by the
                          European Space Agency

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                         DISCLAIMER OF WARRANTY

Considerable effort has been put into the development of EGOPS V4.0 - a major
upgrade of EGOPS V3.0 for which the disclaimer of warranty is found further
below - in order to make it operate smoothly, accurately and as error- and
bug-free as possible.
Nevertheless, no warranties are made, expressed or implied, that EGOPS V4.0
is free of error, or that it will entirely meet the requirements of any
particular application. EGOPS V4.0 should not be solely relied on for
solving a problem whose incorrect solution could result in injury to a
person or loss of property. IGAM/UG and its development partners (AAE,
MetO, and ESA) disclaim any liability for direct, consequential, or
incidental damages resulting from the use of EGOPS V4.0 or its output.

--------------------------------------------------------------------------------

                           POINTS OF CONTACT

Any requests, comments, inquiries, and bug reports concerning the EGOPS4
software package should be directed to:
```

Gottfried Kirchengast
Director, International EGOPS Maintenance Center (IEMC)
Institute for Geophysics, Astrophysics, and Meteorology
University of Graz
Universitaetsplatz 5
A-8010 Graz
Austria
Fax: +43-316-380 9825
E-Mail: gottfried.kirchengast@uni-graz.at
IEMC Website: http://www.uni-graz.at/igam-iemc

Points of contact at ESA, AAE, and MetO are:

```
pierluigi.silvestrin@esa.int (Pierluigi Silvestrin, ESA)
manfred.sust@space.at        (Manfred Sust, AAE)
sbhealy@metoffice.com        (Sean B. Healy, MetO)
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"Never seen occultations so bright. - EGOPS."

BASIC EGOPS4 AVAILABILITY INFORMATION
by the
International EGOPS Maintenance Center (IEMC) hosted by IGAM/UG

BRIEF INFORMATION ON THE IEMC:

The IEMC is a Service Center set up at IGAM/UG as part of a tri-lateral "EGOPS Licensing Agreement" amongst the EGOPS2 developers IGAM/UG, DMI, and TERMA with the mission to provide, at best-effort within available resources, maintenance and user support services for the EGOPS2 user community.

The IEMC continues and enhances this mission with EGOPS4. See the condensed information below and the more extended IEMC section in the EGOPS.ReadMe file for further details on the services of the IEMC (within EGOPS4 see "Help - EGOPS explained - EGOPS SetUp & Use Notes", within the EGOPS4 Software User Manual see Appendix C). Also the IEMC Website ! http://www.uni-graz.at/igam-iemc ! conveniently provides all further information.

EGOPS4 LICENSING AND DISTRIBUTION:

The three types of EGOPS4 Licenses available are Commercial User Licence (COL), Science User Licence (SCL), and ESA User License (ESL), respectively. COLs and ESLs are (without exemptions) licenses for run-time versions, while SCLs are usually granted for source-code versions if certain conditions are fulfilled by the potential Licensee. ESLs are available, basically free of charge, via ESA for parties in ESA Member States.

The sole distributor of EGOPS4 source-code versions to qualified SCL Licensees is the IEMC at IGAM/UG. The IEMC is also the sole distributor of EGOPS4 run-time versions to either COL or SCL Licensees. The sole distributor of EGOPS4 run-time versions to qualified ESL Licensees is ESA/ESTEC, which distributes software after ESL User registration and authorization by the IEMC.

Parties interested in COLs or SCLs should contact, for further information and draft license letters, the Director of the IEMC (see address under POINTS OF CONTACT above). Parties interested in ESLs should contact ESA/ESTEC at the ESA point of contact given above.

Informal CUSTOMER INFORMATION:

Science Users -> EGOPS4 may be used free of charge (only 99,- EUR standard charge for delivery-related costs) for scientific, non-profit research and teaching purposes. Qualified institutions can obtain such a Science User License (SCL) for the EGOPS4 software from the IEMC, against signing an appropriate license agreement. An SCL is usually granted as full source-code license free of charge ("at a freely negotiated fee with no predetermined minimum" in formal words). Note: Misuse of an SCL, e.g., for commercial purposes, is a serious violation of license terms and thus prohibited. Help us with your fairness to maintain our casual SCL distribution policy for EGOPS,

```
   in the interest of all of us in our science community worldwide.

Commercial Users -> Contact the IEMC at IGAM/UG for information on how to
   obtain Commercial-User Licenses (COLs) and on current sales price ranges.
   We also can advise you whether you qualify for ESA-User Licenses (ESLs),
   which are basically free of charge, and give you effective guidance this
   way if applicable.

Science and Commercial Users -> As the World's No.1 Center in EGOPS we offer
   much more than just distributing Licenses: Learn about our support and
   training service packages. Learn about our study and consulting services
   covering the full field of occultation science and applications in meteoro-
   logy and geophysics, and more. Learn about the highlights of EGOPS4, on the
   plans in the pipe for EGOPS5, etc.
   All these services are open to all Licensees, whether COL, ESL, or SCL Users.
   Contact us and we will be happy to offer a service solution tailored to your
   needs.

               "Never seen occultations so bright. - EGOPS."

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-Begin of EGOPS3 Reference Information-----------------------------------------

EGOPS3, the result of the first three EGOPS development cycles carried out from
1996-2000, was a major improvement of the previous EGOPS2 software.

The final official EGOPS3 version was EGOPS3.0/Rel#3. - Here is, for traceback
reference, the official "About EGOPS..." information of that version:

              End-to-end GNSS Occultation Performance Simulator
                  Version 3.0, Release#3, March 15, 2000

           EGOPS(R) V3.0 (EGOPS3) was developed as a major upgrade
                 of EGOPS2 (reference information appended)
                       by an International Consortium
                              involving Teams at

           Institute for Geophysics, Astrophysics, and Meteorology
                   University of Graz (IGAM/UG), Austria

               Danish Meteorological Institute (DMI), Denmark

                European Space Agency (ESA), The Netherlands

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         IGAM/UG Team: G. Kirchengast (Leader of EGOPS development),
             W. Poetzi (aka Muehlmann), J. Ramsauer, A. Veronig,
               M. Gorbunov (IAP Moscow), G. Holler, A. Steiner

              DMI Team: S. Syndergaard, G.B. Larsen, P. Hoeg

                  ESA Team: P. Silvestrin, A. Tobias

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                  Developed with financial support by the
                          European Space Agency

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                         DISCLAIMER OF WARRANTY

Considerable effort has been put into the development of EGOPS V3.0 - a major
upgrade of EGOPS V2.1 for which the disclaimer of warranty is found further
below - in order to make it operate smoothly, accurately and as error- and
bug-free as possible.
```

```
Nevertheless, no warranties are made, expressed or implied, that EGOPS V3.0
is free of error, or that it will entirely meet the requirements of any
particular application. EGOPS V3.0 should not be solely relied on for
solving a problem whose incorrect solution could result in injury to a
person or loss of property. IGAM/UG and its development partners (DMI
and ESA) disclaim any liability for direct, consequential, or incidental
damages resulting from the use of EGOPS V3.0 or its output.

--------------------------------------------------------------------------------

                           POINTS OF CONTACT

Any requests, comments, inquiries, and bug reports concerning the EGOPS3
software package should be directed to:

           Gottfried Kirchengast
           Director, International EGOPS Maintenance Center (IEMC)
           Institute for Geophysics, Astrophysics, and Meteorology
           University of Graz
           Universitaetsplatz 5
         A-8010 Graz
           Austria
           Fax: +43-316-380 9825
        E-Mail: gottfried.kirchengast@kfunigraz.ac.at

Points of contact at DMI and ESA are:

           ssy@dmi.dk             (Stig Syndergaard, DMI)
           psilvest@estec.esa.nl (Pierluigi Silvestrin, ESA)

-End of EGOPS3 Reference Information--------------------------------------------

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-Begin of EGOPS2 Reference Information------------------------------------------

EGOPS2, the result of the first two EGOPS development cycles carried out from
1996-1998, was the first officially available EGOPS tool.

The final official EGOPS2 version was EGOPS2.1/Rel#2. - Here is, for traceback
reference, the official "About EGOPS..." information of that version:

              End-to-end GNSS Occultation Performance Simulator
                  Version 2.1, Release#2, October 15, 1999

                             Developed by an
                         International Consortium
                            involving teams at

                 Institute for Meteorology and Geophysics,
                   University of Graz (IMG/UoG), Austria

                   TERMA Elektronik A/S (TERMA), Denmark

               Danish Meteorological Institute (DMI), Denmark

                European Space Agency (ESA), The Netherlands

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--------------------------------------------------------------------------------

         IMG/UoG Team: G. Kirchengast (Leader of EGOPS development),
            J. Ramsauer,  W. Muehlmann,  G. Holler,  K. Holler,
           W. Rothleitner, K. Hocke, A. Steiner, U. Foelsche

               TERMA Team: K. Schultz, D. Hansen, L. Maresi

              DMI Team: S. Syndergaard, M. Mortensen, P. Hoeg

               ESA Team: P. Silvestrin, J. Fuchs, A. Tobias
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                  Developed with financial support by the
                          European Space Agency

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                         DISCLAIMER OF WARRANTY

Considerable effort has been put forth in the development of EGOPS V2.1 to
make it operate smoothly, accurately and as error- and bug-free as possible.
Nevertheless, no warranties are made, expressed or implied, that EGOPS V2.1
is free of error, or that it will entirely meet the requirements of any
particular application. EGOPS V2.1 should not be solely relied on for
solving a problem whose incorrect solution could result in injury to a
person or loss of property. IMG/UoG and its development partners (TERMA, DMI,
and ESA) disclaim any liability for direct, consequential, or incidental
damages resulting from the use of EGOPS V2.1 or its output.

--------------------------------------------------------------------------------

                           POINTS OF CONTACT

Any comments, inquiries, and bug reports concerning the EGOPS2 software
package should be directed to

        Gottfried Kirchengast
        Institute for Meteorology and Geophysics, University of Graz
        Halbaerthgasse 1
      A-8010 Graz
        Austria
   Fax: +43-316-380 9825
E-Mail: gottfried.kirchengast@kfunigraz.ac.at

Points of contact at TERMA, DMI, and ESA are

        kds@terma.com          (Keld Schultz, TERMA)
        ssy@dmi.dk             (Stig Syndergaard, DMI)
        psilvest@estec.esa.nl  (Pierluigi Silvestrin, ESA)

-End of EGOPS2 Reference Information--------------------------------------------
```

8 Common Dialogs

8.1 Quit and Save

8.1.1 OK

```
DESCRIPTION

Pressing the 'OK' button causes all values, droplist settings, text
field entries etc. to be accepted as the current input status (whereas
pressing 'Cancel' means to drop the changes just made in this input
window). After pressing 'OK', the input window will be closed.
```

8.1.2 Quit

```
GENERAL DESCRIPTION

Pressing the 'Quit' button causes all input (values, droplist and button
entries etc.) to be lost and closes the currently open input window (im-
mediate reopening of the input window will only show the last saved- or
the default settings of the window).


SPECIAL NOTES/HINTS

- No warning will be issued in case you attempt to quit an input window.
```

8.1.3 Save & Compute

```
GENERAL DESCRIPTION

Pressing the 'Save & Compute' button causes two actions.
1) All input (values, droplist and button entries, etc.) will be
saved under the chosen Task-id, i.e., in a file named <Task-id>.inp (an
overview of the current input state can be seen anytime by clicking the
'Input Summary' button).
2) After saving, EGOPS starts the numerical calculation by employing the
corresponding computational system (e.g. the Mission Analysis/Planning
System [MAnPlSystem], which corresponds to a software package written in
FORTRAN 90). It performs all necessary computations based on to the
current input and produces all the needed result files for subsequent
processing and visualization. (To learn more about the file structure
behind EGOPS, consult the "EGOPS explained..." Help entry of the main-level
Help menu.)
After starting a computation, an 'Information Window' pops up with a short
hint about the expected computation time, followed by a second
'Information Window' when the computations are finished.


SPECIAL NOTES/HINTS

- A warning will be issued in case you attempt to save the input with
  an already existing Task-id. You can then decide to either supersede
  (and loose) the existing information or to rename your Task.
  (Very special hint: to forget about it may be wise sometimes...)
- Be careful in selecting your simulation input parameters in order not to
  waste computation time and disk space for results not really exploited.
  Note that some input combinations (very long simulation time ranges together
```

```
  with dozens of satellites and fiducial sites, etc.) can of result in
  extremely long computation times.
- The estimated calculation time is only a rough estimation of the real
  value, based on a so called 'Whetstone' test. However, you will always be
  provided with a posterior information on how long a computation really took.
- The 'Save & Compute' button always starts EGOPS jobs online (the EGOPS
  user interface is blocked during the whole time of the calculation).
  Therefore, for longer and more time consuming EGOPS calculations, the
  EGOPS 'Batch...' button offers to start the same job in the background so
  the EGOPS user interface can be utilized for other activities.


INPUT PARAMETER(S)

 1) === BUTTON for Save & Compute ===

    Purpose:
       Saves the input for the currently open Task-id and launches the
       corresponding MAnPl-, FoMod-, OSMod-, or InRetSystem (the MAnPl-,
       FoMod-, OSMod-, and InRetSystem.x executables are located in the
       /prog/FORprog directory of EGOPS) computations.

    Type:
       Button

    Format/Usage:
       Click button for saving and computing.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The button is always available.
       If a file required is missing or incorrect (e.g., due to inappropriate
       direct manipulation by the user), the program may abnormally terminate
       with a message of varying information content in your console window.
       (So be careful with any "super-user" tricks...). Note that an abnormal
       termination of the FORTRAN System will not inflict the User I/F in any
       way. Thus, after correcting a problem "behind the scene", you can pro-
       ceed as usual. (To learn more about Error Handling related to EGOPS,
       consult the appropriate sections of the User Manual.)


INPUT EXAMPLE(S)

- Command Save & Compute:
   Press the 'Save & Compute' button and let your machine work (dependent
   on your task you may have some time for other work now...)
```

8.1.4 Save Input

```
GENERAL DESCRIPTION

Pressing the 'Save Input' button causes all input (values, droplist and button
entries, etc.) to be saved with the present Task-id, i.e., in a file
named <Task-id>.inp (an overview of the current input state can be seen
anytime by clicking the 'Input Summary' button).


SPECIAL NOTES/HINTS

- A warning will be issued in case you attempt to save the input with an
  already existing Task-id. You may then decide to either supersede (and
  loose) the existing information or to rename your Task.
  (Very special hint: sometimes it may be wise to even forget about it...)
```

8.2 Reset Defaults

8.2.1 Reset Defaults

GENERAL DESCRIPTION

Pressing the 'Reset Defaults' button causes all input (values, droplist and button entries, displayed plots etc.) to be lost and all values and settings will be reset to its defaults. Reset to defaults has the same effect as entering an EGOPS input window for the first time (i.e. the default Task-id settings are loaded).

SPECIAL NOTES/HINTS

- No warning will be issued in case you attempt to press the reset to defaults button of an EGOPS input window.

8.3 Show Input Summary

8.3.1 Input Summary

GENERAL DESCRIPTION

Pressing the 'Input Summary' button opens a Pop-up Window containing full information on the current state of all your input to the current Task. This information can be checked easily, since it is in the form of a convenient list, or it may be saved to a PostScript file (for subsequent print-out).

SPECIAL NOTES/HINTS

- The list presented in the input summary window exactly resamples the contents and format of the <Task-id>.inp file. So, in case one just forgot to document the input by preparing PS output, one can still print out the same information in ASCII form by directly printing the <Task-id>.inp file.

INPUT PARAMETER(S)

1) === BUTTON for opening Input Summary Pop-up Window ===

   Purpose:
      To show, check and document the input of a Task by a convenient grouped-list summary (which exactly stores what is/has been delivered as input for the corresponding computations).

   Type:
      Button

   Format/Usage:
      Press the Button to open the Pop-up Window. By pressing 'Print to PS file', PS output of the input summary can be generated (in the /PSFiles subdirectory of the current Project directory). Dismiss the window by pressing 'Ok'.

   Range of Values:

   Notes on Values:

```
      ---

    Availability/Indirect Effects:
       Button is always available.
```

INPUT EXAMPLE(S)

- Opening Input Summary Window, check input, then leave it:
  Press button 'Input Summary' to pop up the summary window; after finishing your check, press 'Ok' within the window to close it.

8.4 Batch Jobs

8.4.1 Batch...

GENERAL DESCRIPTION

Pressing the 'Batch...' button opens a Pop-up Window for saving and computing the currently open task offline in EGOPS batch mode. Especially for longer runs, computing in EGOPS batch mode offers the best way to save valuable time because one can do further online work within EGOPS while the computer does the rest autonomously in the back-ground (without blocking the graphical EGOPS interface in the mean time as it would be the case during an EGOPS online calculation). The batch job processing Pop-up Window allows to select the start time of the EGOPS Batch-Job and offers the possibility to show further batch job status information via an extra Pop-up Window.

SPECIAL NOTES/HINTS

- The batch window offers four different start time modes.

INPUT PARAMETER(S)

```
 1) === BUTTON for opening Batch window ===

    Purpose:
       This Pop-up Window allows to set the EGOPS Batch-Job start time
       and allows to show additional Batch-Job status information.

    Type:
       Button for activating the Batch window.

    Format/Usage:
       Press the 'Batch...' button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

- Open the Batch... Pop-up Window:
  Press the 'Batch...' button.

8.4.2 Batch Info...

```
GENERAL DESCRIPTION

Pressing the 'Batch Info...' button opens a batch job status information
Pop-up Window. This window contains batch job status information like the
job-id, project-id, task-id, start time, status, and the PID number of
all EGOPS batch jobs listed. It's also possible to remove finished tasks,
terminate running tasks or to restart tasks from the EGOPS batch job list.


SPECIAL NOTES/HINTS

- For a better overview, it is recommended to remove all finished tasks
  from time to time from the list to keep the batch job status information
  list as short as possible.


INPUT PARAMETER(S)

 1) === BUTTON for opening the Batch Info window ===

    Purpose:
       This Pop-up Window allows to monitor the status of all active
       or pending Batch-Jobs.

    Type:
       Button for activating the Batch Info window.

    Format/Usage:
       Press the 'Batch Info...' button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Getting batch job process information:
   Press the 'Batch Info...' button.
```

8.4.3 Start Time

```
GENERAL DESCRIPTION

This input group allows to specify the start time of an EGOPS batch
job. There are three fixed start times offered and one user defined
(only the user defined start time needs manual data input).


SPECIAL NOTES/HINTS

- The batch job start time option "Now" means that the job will start
  at the next available full minute.


INPUT PARAMETER(S)

 1) === DROPLIST for Batch Job Start Time Choice ===

    Purpose:
       Allows the selection of three predefined Batch Job start times
```

```
       by mouse-click or allows to choose a user defined start time.

    Type:
       Droplist with different entries available for selection.

    Format/Usage:
       Click button for dropping the list, then click on desired entry.
       The droplist-button always shows the current setting.

    Range of Values:
       One of the following 4 values: 'Now', 'Noon', 'Midnight', 'User Input'

    Notes on Values:
       'Now' means that the job will start at the next available full minute.
       'Noon' starts the Batch Job at 12h (today, if the droplist was clicked
       before noon or tomorrow, if this action was done after noon).
       'Midnight' starts the job at midnight.
       'User Input' renders the input fields for User defined start time
       Input sensitive.

    Availability/Indirect Effects:
       The droplist is always available.


 2,3,4) === INPUT FIELDS for Arbitrary Start Time Definition ===

    Purpose:
       Allows to select an arbitrary Batch Job Start Time by directly
       specifying the desired day, hours and minutes.

    Type:
       Text input fields for input of two digit numerical values for
       day, hour and minute.

    Format/Usage:
       Supply the numerical two digit integer values.
       Press <CR> to deliver the input to the system.

    Range of Values:
       The values for the day input may range from today (default) up to
       eight days in the future.
       For the hour input, the value range is from 0 to 24.
       The minutes range is from 0 to 59.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if the droplist for start time is set to 'User Input'.


INPUT EXAMPLE(S)

- Selecting a start time of 15th 2 a.m. (only possible if no more than 8 days
   are between today and the 15th):
   Set droplist to 'User Input'
   Set day input field to '15', hour input field to '2', and the min input
   field to '0'
```

8.4.4 Batch Jobs

```
GENERAL DESCRIPTION

Pressing the 'Jobs...' button opens a Pop-up Window for all kind of
important batch job status information.


SPECIAL NOTES/HINTS
```

```
- The Jobs... window is only for information purposes (no input is
  possible).


INPUT PARAMETER(S)

 1) === BUTTON for opening the Jobs... window ===

    Purpose:
       This Pop-up Window allows to monitor (and change) the status
       of all active or pending Batch-Jobs.

    Type:
       Button for activating the Jobs... window.

    Format/Usage:
       Press the 'Batch Info...' button to open the Pop-up Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Getting batch job process information:
   Press the 'Jobs...' button.
```

8.4.5 Batch Processing Information

```
GENERAL DESCRIPTION

The Batch Processing Information Window shows important status information
about all internal EGOPS batch jobs. It is also possible to terminate running
tasks, remove tasks or restart former tasks.


SPECIAL NOTES/HINTS

- The Batch Processing Information window is only for information purposes
  (no direct input is possible). Nevertheless,  it is possible to interact
  with the window content via the 'Terminate Task', 'Remove Task' or the
  'Restart Task' buttons.


INPUT PARAMETER(S)

 1) === LIST for showing important Batch Processing Information ===

    Purpose:
       This List Widget allows to monitor the status of all finished,
       active or pending EGOPS Batch Jobs (jobs which were not
       correctly finished, are also listed with its corresponding
       error status).

    Type:
       List for showing important Batch Processing Information.

    Format/Usage:
       ---

    Range of Values:
       The List shows the following parameters: 'Job-Id', 'Project_Id',
       'Task-Id', 'Start Time', 'Status', 'PID'.
```

Notes on Values:
'Job-Id' is the Job-Id of the Batch Job. The 'Project_Id' is the name of the (open) project from where the Batch Job was started. 'Task-Id' denotes the individual name of your Batch Job Task. The 'Start Time' shows the actual Batch Job Start Time (the first 4 digits are the year, the next two are the month and the last two before the comma are the day number; the first two digits after the comma are the hours and the last two digits are the minutes). The 'Status' can have 4 different values: 'pending', 'running', 'finished', or 'error'. The 'PID' (Process Identifier) is the Batch Job Process Identification number.

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

- Search for the start time of the last batch job:
  Look for the last number of the Start Time column.

8.4.6 Refresh

GENERAL DESCRIPTION

Pressing the 'Refresh' button shows a menu of three pull-down buttons. This three pull-down buttons offer different refresh rates of the Batch Processing Information window content. The range of refresh rates are immediate (now), medium and long refresh rates.

SPECIAL NOTES/HINTS

- The default refresh rate is set to 'Refresh now'.

INPUT PARAMETER(S)

1) === BUTTON for activating three Pull-Down Buttons ===

Purpose:
These Buttons allow to adjust the refresh rate of the Batch Processing Information window content.

Type:
3 Pull-down buttons for activating the desired refresh rate.

Format/Usage:
Press the Refresh button to activate the 3 pull-down buttons. Then press the button with the desired refresh rate.

Range of Values:
Pressing the Refresh button shows three pull-down buttons: 'Refresh now', 'Medium Refresh Rate', and 'Long Refresh Rate' (from top to bottom).

Notes on Values:
'Refresh now' means an immediate refresh of the Batch Processing Information window content, 'Medium Refresh Rate' a refresh every 10 sec., and 'Long Refresh Rate' makes a refresh of the Batch Processing Information window content every 50 seconds.

Availability/Indirect Effects:
Always available.

INPUT EXAMPLE(S)

```
- Activating a medium refresh rate:
   Press the 'Refresh' button and then click on the 'Medium Refresh Rate'
   pull-down button.
```

8.4.7 Terminate Task

```
GENERAL DESCRIPTION

This button can be used to delete a running batch job from the Batch
Processing Information list.


SPECIAL NOTES/HINTS

- The 'Terminate Task' button is only active, if the user has clicked
  with the left mouse button on a running job (displayed in the list)
  previously.


INPUT PARAMETER(S)

 1) === BUTTON for Terminating a running Batch Job ===

    Purpose:
       The button allows to delete a running batch job.

    Type:
       Button for terminating a running task.

    Format/Usage:
       First click with the left mouse button on the desired running
       batch job for activating the 'Terminate Task' button, then press
       the 'Terminate Task' button to kill the selected running batch
       job.

    Range of Values:
       ___

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Terminate Task' button is only active, if the user selects
       a running batch job with the left mouse button previously.


INPUT EXAMPLE(S)

- Kill a running Task-Id:
   Click with the left mouse button on the running Task-Id in the list,
   then press the 'Terminate Task' button to kill the selected running
   task.
```

8.4.8 Restart Task

```
GENERAL DESCRIPTION

This button allows to restart batch jobs which have terminated with
an error status.


SPECIAL NOTES/HINTS

- The 'Restart Task' button is only active, if the user has clicked with
  the left mouse button on a listed batch job that has terminated with an
  error status.
```

```
INPUT PARAMETER(S)

 1) === BUTTON for Restarting a Batch Job ===

    Purpose:
       The button allows to restart batch jobs which have terminated
       with an error status.

    Type:
       Button for restarting batch tasks.

    Format/Usage:
       First click with the left mouse button on the desired batch job
       (that has an error status) for activating the 'Restart Task' button,
       then press the 'Restart Task' button to start the selected batch
       job again.

    Range of Values:
       ___

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Restart Task' button is only active after the user has clicked
       with the left mouse button on a crashed batch job that is recorded in
       the Batch Processing Information list.


INPUT EXAMPLE(S)

- Restarting a Task-Id:
   Click with the left mouse button on the desired Task-Id with error
   status in the list, then press the 'Restart Task' button to restart
   the selected task from the Batch Processing Information list.
```

8.4.9 Remove Task

```
GENERAL DESCRIPTION

This button can be used to remove finished batch jobs from the Batch
Processing Information list.


SPECIAL NOTES/HINTS

- The 'Remove Task' button is only active, if the user has clicked with the
  left mouse button on a finished job previously.


INPUT PARAMETER(S)

 1) === BUTTON for Removing a finished Batch Job ===

    Purpose:
       The button allows to delete finished batch jobs.

    Type:
       Button for removing finished tasks.

    Format/Usage:
       First click with the left mouse button onto the finished batch
       job to activate the 'Remove Task' button, then press the
       'Remove Task' button to remove the selected batch job from the
       Batch Processing Information list.

    Range of Values:
       ___
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Remove Task' button is only active after the user has selected
       a finished batch job with the left mouse button previously.
```

INPUT EXAMPLE(S)

```
- Removing a finished Task-Id:
   Click with the left mouse button on the finished Task-Id in the list,
   then press the 'Remove Task' button to remove the selected task from
   the Batch Processing Information list.
```

8.4.10 Remove finished Tasks

GENERAL DESCRIPTION

This button can be used to remove all finished batch job entries from the Batch Processing Information list.

SPECIAL NOTES/HINTS

- The 'Remove finished Tasks' button is only active, if at least one finished job is indicated in the Batch Processing Information list.

INPUT PARAMETER(S)

```
 1) === BUTTON for Removing all finished Batch Job entries ===

    Purpose:
       The button allows to delete all finished batch job entries.

    Type:
       Button for removing all finished tasks.

    Format/Usage:
       Press the 'Remove finished Tasks' button to remove all batch job
       entries that show the status 'finished' from the  Batch Processing
       Information list.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       The 'Remove finished Tasks' button is only active, if at least one
       finished job is indicated in the Batch Processing Information list.
```

INPUT EXAMPLE(S)

```
- Removing a finished Task-Id:
   Press the 'Remove finished Tasks' button to remove all batch job
   entries that show the status 'finished' from the  Batch Processing
   Information list.
```

8.5 Delete Tasks

8.5.1 Delete Task-Ids

```
GENERAL DESCRIPTION

The Delete Task-ids pop-up widget allows to remove outdated Task-ids from
the currently open project. This tool can be used to delete obsolete
MAnPl-, FoMod-, OSMod-, and InRet-Task-ids by activating the delete
procedure in the MAnPl-, FoMod-, etc. window. All files belonging to the
deleted Task-id will be completely removed and cannot be recovered later,
therefore a warning appears so the user has a last chance to reverse his
action before actually destroying the whole content of the task.


SPECIAL NOTES/HINTS

- Default Task-ids are not shown in the list of existing Tasks because
  it is not allowed to delete the default EGOPS Task-ids.


INPUT PARAMETER(S)

 1) === LIST WIDGET for showing existing Task-ids ==========================

    Purpose:
       Allows to select one (or more) existing Task-id(s) for deleting by
       clicking on the selected task(s).

    Type:
       List widget which allows to select by mouse-click an entry from a list
       of available entries for deleting.

    Format/Usage:
       Click on the selected Task-id(s).

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) ===  BUTTONS for moving Task-ids between the two task listings =========

    Purpose:
       Allows to move the selected Task-id(s) from the 'Existing Tasks:'
       list to the 'Task to delete:' list (upper arrow button) and vice
       versa, in case one reverses the decision to delete a special task
       or a group of tasks (lower arrow button).

    Type:
       Bitmap buttons which allow to move the selected tasks between the
       two list widgets (existing tasks and tasks to delete).

    Format/Usage:
       Press the button which moves the selected task entry from one list
       to the other.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
```

```
      Available only, if a task was highlighted by mouse click.


 3) ===  DELETE BUTTON for deleting existing Task-ids ====================

    Purpose:
       Allows to delete all Task-id(s) listed in the Tasks field 'Tasks
       to delete:' at once. Before actually deleting the content of the
       list, a warning pops up so the user could also abandon his decision
       at the last moment or can press the ok-button for deleting the
       selected (group of) task(s).

    Type:
       Button which allows to delete the selected Task-id(s) by mouse-click.

    Format/Usage:
       Press the button which causes a warning window to pop-up and then
       press 'Ok' or 'Cancel' the action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Available only, if there is at least one Task-id in the Tasks to
       delete list (otherwise the delete button is insensitive).


INPUT EXAMPLE(S)

- Selecting a Task-id for deleting:
   Click on the chosen Task-id in the existing Tasks list with the mouse.
   Next press the upper arrow button to move the selected Task-id to
   the 'Tasks to delete' list. Then press the delete button and confirm
   the action by pressing the Ok-button of the warning pop-up widget
   (which allows also to 'Cancel' this action in the last minute,
   if the wrong Task-id has been chosen).
```

8.6 Text Editor

8.6.1 Text Editor

```
GENERAL DESCRIPTION

This Text Editor opens files and the edited text can then be saved by
pressing the "Save & Quit". The "Save & Quit" command writes the text
file back to the disk and will force the editor to close and return.
The "Print to PS file" button saves the content of the opened file and
creates a PS file in the subdirectory /PSfiles of the current Project.
The "Cancel" button will cause the editor to close the text window
without saving any modifications. To search for text in the text editor,
enter the desired text into the "Find Text" field and click the
"Find" button.


SPECIAL NOTES/HINTS

- The text editor is a modified/adjusted version of a similar "editor"
  widget contained in the IDL software package.
- If the width of the text is more than 80 chars or the text length is
  more than 25 lines, use the horizontal/vertical sliders for navigating
  through the text.


INPUT PARAMETER(S)
```

```
1) === INPUT FIELD for editing a text file ===

   Purpose:
      Allows to edit text files by keyboard input.

   Type:
      Text input field for editing the file content.

   Format/Usage:
      Perform the desired editing of the file. (Up-Down, Left-Right,
      Backspace, etc., navigation is similar as with "typical" text
      editors.)

   Range of Values:
      No limitations foreseen.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


2) === INPUT FIELD for Find Text ===

   Purpose:
      Allows to set a search string by keyboard input.

   Type:
      Text input field for input of a search string.

   Format/Usage:
      Type in a search string and confirm it.
      Press <CR> to deliver the input to the system.

   Range of Values:
      No limitations foreseen.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


3) === Find BUTTON ===

   Purpose:
      Allows to search for text in the file that is equal to the search
      string. The editor's text field moves to the text block and
      highlights the string found.
      Repeated use of the "Find" button searches for all occurrences from
      the present cursor position downwards (cycling through the text file).
      A "Not found" message indicates that the string did not occur.

   Type:
      Button

   Format/Usage:
      Press the "Find" button to find any occurrence of the search string
      in the text of the file.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Available after the chosen search string input was confirmed.
```

```
 4) === Save & Quit BUTTON (& Cancel button) ===

    Purpose:
       Allows to save the edited text and close the window.

    Type:
       Button

    Format/Usage:
       Pressing the "Save & Quit" button causes the text file to be saved
       with its current contents (for instance, the protocol file of the
       EGOPS Project "LetsLearnEGOPS1" is saved to LetsLearnEGOPS1.log located
       in the /LetsLearnEGOPS1 subdirectory of EGOPS).
       Pressing "Cancel" causes a return without action.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 5) === Print to PS file BUTTON ===

    Purpose:
       Save text file content as <textfilename>.ps file in the /PSfiles
       subdirectory of the current Project. For instance, the file
       /EGOPS/LetsLernEGOPS1/LetsLearnEGOPS1.log is saved as PostScript file
       to /EGOPS/LetsLearnEGOPS1/PSfiles/LetsLearnEGOPS1.log.ps.

    Type:
       Button

    Format/Usage:
       Press the Print to PS file Button which opens an Information-Message
       Window. Press "OK" then delivers the file content to the appropriate
       /PSFiles subdirectory and, by closing the Information-Message Window,
       returns to the text editor window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Button is always available.


INPUT EXAMPLE(S)

- Search for the string 'EGOPS' in a text file:
   Type 'EGOPS' into the "Find Text" field and confirm the input,
   which leads you to the 1st occurrence of the string, if any. Then
   press the "Find" button to see all occurrences of the string
   'EGOPS' in the whole text.
```

8.7 Pickfile

8.7.1 File Selection

```
GENERAL DESCRIPTION

This file selection widget lets you pick a file. The files are shown in
the field to the right. You can select a file by clicking on it with the
mouse or by typing the filename directly into the selection field. Pressing
of the "OK" button will accept the choice (the "Cancel" button will close
the file selection widget without any action done).


SPECIAL NOTES/HINTS

- This pop-up is a modified/adjusted version of a similar "pickfile"
  widget contained in the IDL software package.
- Path and Filter are non editable. Their only purpose is to show the user,
  in which directory the displayed files are located and through which
  filter they have been pre-selected. Also, there is a "Subdirectories" field
  that is ignored within EGOPS (always set insensitive).
- The fastest way to select a file from the list is by double-clicking on it.
  This makes the choice immediately accepted and closes the window without
  additionally clicking on the "OK" button.


INPUT PARAMETER(S)

 1) === FIELD for Path ===

    Purpose:
       Actually no input, just for display.
       Shows the full directory path for the selected files.

    Type:
       Text field (non editable).

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) === FIELD for Filter ===

    Purpose:
       Actually no input, just for display.
       The filter is automatically set to the file type appropriate in
       the given context.

    Type:
       Text field (non editable).

    Format/Usage:
       ---

    Range of Values:
       ---

    Notes on Values:
```

```
      ---

   Availability/Indirect Effects:
      Always available.


3) === Files List ===

   Purpose:
      To show the whole list of existing files for the selected file type.
      Allows to select one file which is then placed into the "Selection"
      field.

   Type:
      List

   Format/Usage:
      Click on a filename in the list to select that file. The filename
      is then shown in the "Selection" field below.

   Range of Values:
      All filenames in the list.

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Only available, if at least one file of the required file type was
      found (which is, based on the basic EGOPS installation, always
      true).


4) === INPUT FIELD for Selection ===

   Purpose:
      To provide file selection by direct input of the filename by
      keyboard or to show the file selection done by mouse-click in the
      "Files List", respectively.

   Type:
      Text input field.

   Format/Usage:
      Choose an existing filename by direct keyboard input.
      Press <CR> to deliver the input to the system.

   Range of Values:
      One of the existing filenames out of the "Files List".

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available.


5) === OK BUTTON (& Cancel button) ===

   Purpose:
      Allows to save the selected filename and closes the window.

   Type:
      User I/F: Button

   Format/Usage:
      Press the "OK" button to confirm selection of the file.
      (Press "Cancel" to return without action.)

   Range of Values:
      ---
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.
```

INPUT EXAMPLE(S)

```
- Select, for instance, the existing filename 'file1.txt':
   Click on 'file1.txt' in the "Files List" and then press the
   "OK" button.
```

8.8 Atmosphere Data Path/File Selection Input

8.8.1 GCM3D Atmosphere Data Path/File Selection

GENERAL DESCRIPTION

This input group allows to specify the GCM Data File Name by selecting the GCM Data File Path and then, by means of the "Pick-file-Widget", the GCM Data File Name can be selected.

SPECIAL NOTES/HINTS

```
- It is only possible to choose the GCM Data File Name by clicking the
  'GCM Data File Name...'-button and select one name from the list.
- All 'GCM Data File Names' are standardized file names of the form:
  <filenameYYYYMMDDHHL.grb> (YYYY are the four digits for the year
  number, MM and DD are symbolic for the month- and day number, and
  HH and L are for the hours and the level designation). For L = 1, the
  HH number is free between 00 and 24, whereas for L = 2, 4, or 8, HH
  is fixed and set to 00. Level L = 2 means two time layers (00 and 12h),
  L = 4 means four time layers (00, 06, 12, and 18h),  and level 8 denotes
  eight different time layers (00, 03, 06, 09, 12, 15, 18, and 21h).
```

INPUT PARAMETER(S)

```
 1) === INPUT FIELD for selection of the GCM Data File Path ===

    Purpose:
       Allows the input of the GCM Data File Path by keyboard input.

    Type:
       Text input field for input of the GCM Data File Path string.

    Format/Usage:
       Put in the proper GCM Data File Path.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.

 2) ===  BUTTON/PICKFILE-LIST WINDOW for selecting an GCM Data File ===

    Purpose:
       Allows to select an existing GCM Data File out of all existing ones.
```

```
    Type:
       Pop-up Window which allows to select by mouse click an entry from a
       list of available entries.

    Format/Usage:
       Press the button which causes a pickfile-list window to pop-up. Select,
       by mouse click, a GCM Data File out of the available ones in the list
       (which is highlighted upon selection). Confirm your selection with
       "OK" or choose "Cancel" to return without action.

    Range of Values:
       Any File Name available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for showing the chosen GCM Data File Name ===

    Purpose:
       Shows the selected GCM Data File Name.

    Type:
       Text input field (not editable).

    Format/Usage:
       ---

    Range of Values:
       All existing GCM Data File Names.

    Notes on Values:
       The GCM Data File Names are of the form: <filenameYYYYMMDDHHL.grb>
       (cf. SPECIAL NOTES/HINTS)

    Availability/Indirect Effects:
       Always available.


INPUT EXAMPLE(S)

- Selecting /home/EGOPS/GCM/ as GCM Data File Path:
   Set the text string in the GCM Data File Path input field to
   '/home/EGOPS/GCM/'.
```

8.8.2 HiVRes Atmosphere Data Path/File Selection

```
GENERAL DESCRIPTION

This input group allows to specify the RAOB Data File Name by selecting
the RAOB Data File Path and then, by means of the "Pick-file-Widget",
the RAOB Data File Name can be selected.


SPECIAL NOTES/HINTS

- It is only possible to choose the RAOB Data File Name by clicking the
  'RAOB Data File Name...'-button and then select one name from the list.
- All 'RAOB Data File Names' are standardized file names of the form:
  <filenameLaLaHnsLoLoLoHewYYYYMMDDhhmm.raob> (LaLa are the two digits
  for the latitude, one digit Hns depicts the hemisphere [N for northern
  or S for southern hemisphere], LoLoLo are three digits describing the
  longitude, Hew describes the eastern- or western hemisphere [E for the
  eastern- or W for the western hemisphere], YYYY are the four digits of
  the year number, MM and DD designate the month- and day number,
  and hh and mm are for the hours and minutes designation).
```

```
INPUT PARAMETER(S)

 1) === INPUT FIELD for selection of the RAOB Data File Path ===

    Purpose:
       Allows the input of the RAOB Data File Path by keyboard input.

    Type:
       Text input field for input of the RAOB Data File Path.

    Format/Usage:
       Put in the proper RAOB Data File Path.
       Press <CR> to deliver the input to the system.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2) ===  BUTTON/PICKFILE-LIST WINDOW for selecting an RAOB Data File ===

    Purpose:
       Allows to select an existing RAOB Data File out of all existing ones.

    Type:
       Pop-up Window which allows to select by mouse click an entry
       from a list of available entries.

    Format/Usage:
       Press the button which causes a pickfile-list window to pop-up. Select,
       by mouse click, a RAOB Data File out of the available ones in the list
       (which is highlighted upon selection). Confirm your selection with
       "OK" or choose "Cancel" to return without action.

    Range of Values:
       Any File Name available in the list.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 3) === INPUT FIELD for showing the chosen RAOB Data File Name ===

    Purpose:
       Shows the selected RAOB Data File Name.

    Type:
       Text input field (not editable).

    Format/Usage:
       ---

    Range of Values:
       All existing RAOB Data File Names.

    Notes on Values:
       The RAOB Data File Names are of the form:
       <filenameLaLaHnsLoLoLoHewYYYYMMDDhhmm.raob>
       (cf. SPECIAL NOTES/HINTS)

    Availability/Indirect Effects:
```

```
       Always available.

INPUT EXAMPLE(S)

- Selecting /home/EGOPS/RAOB/ as RAOB Data File Path:
   Set the text string in the RAOB Data File Path input field to
   '/home/EGOPS/RAOB/'.
```

8.9 PS File Output

8.9.1 PS File Output

```
GENERAL DESCRIPTION

The PS File Output Pop-up Widget is the graphical user interface which
allows to manipulate several output parameters for individual storing
of the plot window content. The resulting output PSfiles are written
into the directory ../EGOPS/genPSfiles for Visualize Geographic Maps
plots and Visualize Volume Data plots or into the PSfiles-subdirectory
of the currently open project (../EGOPS/<Projectname>/PSfiles) for
Visualize MAnPl Statistics and Visualize Validate Profiles plots.


SPECIAL NOTES/HINTS

- It is not possible to manually change the file path for the resulting
  PS output file.


INPUT PARAMETER(S)

 1) === INPUT FIELD for showing or changing the PS Filename ===

    Purpose:
       Allows to change the default PS-Filename.

    Type:
       Editable Text input field for showing and changing the default
       PS-Filename.

    Format/Usage:
       Change the PS-Filename by keyboard input as necessary.
       Press <CR> to deliver the input to the system.

    Range of Values:
       All alphanumeric strings of up to 34 characters length.

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2,3) === Exclusive BUTTONS for Format Choice ===

    Purpose:
       Allows to select between DIN-A4 and Letter Format.

    Type:
       Two exclusive Buttons for selecting between DIN-A4 or Letter Format
       for the PS output file.

    Format/Usage:
       Press the selection button to choose the format.
```

```
   Range of Values:
      On or off.

   Notes on Values:
      Default is DIN-A4 Format.

   Availability/Indirect Effects:
      Always available.


4,5) === Exclusive BUTTONS for PS File Type Choice ===

   Purpose:
      Allows to select between Standard or Encapsulated PS File Type.

   Type:
      Two exclusive Buttons for selecting between Standard or Encapsulated
      PS output file.

   Format/Usage:
      Press the selection button to choose the PS File Type.

   Range of Values:
      On or off.

   Notes on Values:
      Default is the Standard PS-Plot.

   Availability/Indirect Effects:
      Always available.


6,7) === Exclusive BUTTONS for Frame Choice ===

   Purpose:
      Allows to select a PS-Plot with or without Frame.

   Type:
      Two exclusive Buttons to select between a framed or an unframed plot.

   Format/Usage:
      Press the selection button to select the plot output with or without
      frame.

   Range of Values:
      On or off.

   Notes on Values:
      Default is a plot with Frame.

   Availability/Indirect Effects:
      Always available.


8) === OK BUTTON for activating PS-File printing ===

   Purpose:
      Allows to activate PS-File printing with the chosen options
      and closes the PS File Output Pop-up Window (the Cancel
      button closes the Pop-up Window without action).

   Type:
      Button for activating PS-File printing.

   Format/Usage:
      Press the button for printing to the PS-Output File.

   Range of Values:
      ---

   Notes on Values:
```

```
      ---

   Availability/Indirect Effects:
      Always available.


INPUT EXAMPLE(S)

- Choose a frameless PS plot:
   Press the No Frame button.
```

8.10 Color Adjustments

8.10.1 Color Tables

```
GENERAL DESCRIPTION

Plot Colors is a widget based utility for the interactive manipulation of
color tables. It may be used with any EGOPS plot application.
The color table maps the data values written to the screen to different
colors and intensities. Its operation is similar to that of a photographic
wedge. The slope and position of the wedge are manipulated to best display
a particular data set.


SPECIAL NOTES/HINTS

- "Plot Colors" is a modified version of the "XLoadCT" widget tool
  contained in the IDL software package.
- The current color table is always shown in the draw window above the
  first button row.


INPUT PARAMETER(S)

1) === Exclusive BUTTON for Tables [and Options and Function] ===

    Purpose:
       Activates widget sliders for Stretch Bottom, Stretch Top, Gamma
       Correction, and the Color Tables list.

    Type:
       Exclusive button.

    Format/Usage:
       Press the "Tables" button to show the three Sliders and to display
       the Color Tables List.

    Range of Values:
       ---

    Notes on Values:
       "Tables" is the default setting of this exclusive button.

    Availability/Indirect Effects:
       Always available.


 2,3) === SLIDERS for Stretching Bottom and Top ===

    Purpose:
       These sliders control the "contrast" of the color tables, and are
       expressed in percentages of full intensity. The color table wedge
       is "stretched" so that values equal to or less than "Stretch Bottom"
       are set to the lowest color table entry, which is usually black.
       Values equal to or greater than "Stretch Top" are set to the last
```

```
      entry in the color table, usually white or some other bright color.
      Values between the bottom and top are linearly scaled to the color
      table. Making "Stretch Bottom" higher than "Stretch Top" inverts the
      color table.

   Type:
      Slider.

   Format/Usage:
      Drag Slider with the mouse to the desired position.

   Range of Values:
      From 0 to 100 (percent).

   Notes on Values:
      Default is 0 for Stretch Bottom and 100 for Stretch Top.

   Availability/Indirect Effects:
      Always available, if "Tables" or "Options" button is activated.


4) === SLIDER for Gamma Correction ===

   Purpose:
      This slider can be used to compensate for the characteristics of
      your monitor. Values larger than 1.0 have a steeper contrast curve
      at the top end of the ramp, while values less than 1.0 have a steeper
      contrast curve at the bottom end of the ramp.  A value of 1.0 results
      in a linear ramp.

   Type:
      Slider.

   Format/Usage:
      Drag Slider with the mouse to the desired position.

   Range of Values:
      From 0.1 to 10.

   Notes on Values:
      Default is 1.0.

   Availability/Indirect Effects:
      Always available, if "Tables" or "Options" button is activated.


5) === Color Tables LIST ===

   Purpose:
      To show the whole Color Table List available within IDL. Allows to
      select one Color Table from the list.

   Type:
      List

   Format/Usage:
      Click a desired Color Table to select it.

   Range of Values:
      All entries available in the list. The default color table of
      EGOPS is '16 LEVEL'.

   Notes on Values:
      (Browse through the available color tables while you have on-screen
       an image plot, e.g., a "Volume Data" plot, for learning how the
       different color tables look like.)


   Availability/Indirect Effects:
      Always available, if "Tables" button is activated.
```

```
INPUT EXAMPLE(S)

- Select color table "STD GAMMA-II":
   Click on the list entry 'STD GAMMA-II'.
- Select again the EGOPS default table '16 LEVEL':
   Click on the list entry '16 Level'.
```

8.10.2 Color Options

```
GENERAL DESCRIPTION

Plot Colors is a widget based utility for the interactive manipulation of
color tables. It may be used with any EGOPS plot applications. The color
table maps the data values written to the screen to different colors and
intensities. Its operation is similar to that of a photographic wedge.
The slope and position of the wedge are manipulated to best display a
particular data set.


SPECIAL NOTES/HINTS

- "Plot Colors" is a modified version of the "XLoadCT" widget tool
  contained in the IDL software package.
- The current color table is always shown in the draw window above the
  first button row.


INPUT PARAMETER(S)

1) === Exclusive BUTTON for Options [and Tables and Function] ===

    Purpose:
       Activates widget sliders for Stretch Bottom, Stretch Top, Gamma
       Correction, exclusive buttons for manipulating Sliders, Top,
       Stretch, and buttons for Reverse Table, Replace Original Table,
       and Restore Original Table.

    Type:
       Exclusive button.

    Format/Usage:
       Press "Options" button to show the three Sliders, the three pairs
       of exclusive buttons for manipulating Sliders, Top, and Stretch,
       and for showing buttons for Reverse Table, Replace Original Table,
       and Restore Original Table.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2,3) === SLIDERS for Stretching Bottom and Top ===

    Purpose:
       These sliders control the "contrast" of the color tables, and are
       expressed in percentages of full intensity. The color table wedge
       is "stretched" so that values equal to or less than "Stretch Bottom"
       are set to the lowest color table entry, which is usually black.
       Values equal to or greater than "Stretch Top" are set to the last
       entry in the color table, usually white or some other bright color.
       Values between the bottom and top are linearly scaled to the color
       table. Making "Stretch Bottom" higher than "Stretch Top" inverts the
       color table.
```

```
   Type:
      Slider.

   Format/Usage:
      Drag Slider with the mouse to the desired position.

   Range of Values:
      From 0 to 100 (percent).

   Notes on Values:
      Default is 0 for Stretch Bottom and 100 for Stretch Top.

   Availability/Indirect Effects:
      Always available, if "Options" or "Tables" button is activated.


4) === SLIDER for Gamma Correction ===

   Purpose:
      This slider can be used to compensate for the characteristics of
      your monitor. Values larger than 1.0 have a steeper contrast curve
      at the top end of the ramp, while values less than 1.0 have a steeper
      contrast curve at the bottom end of the ramp.  A value of 1.0 results
      in a linear ramp.

   Type:
      Slider.

   Format/Usage:
      Drag Slider with the mouse to the desired position.

   Range of Values:
      From 0.1 to 10.

   Notes on Values:
      Default is 1.0.

   Availability/Indirect Effects:
      Always available, if "Options" or "Tables" button is activated.


5) === Exclusive BUTTONS for Sliders ===

   Purpose:
      "Gang" Sliders connects the "Stretch Bottom" and "Stretch Top". Moving
      one slider moves the other. With the sliders ganged, movement of a
      slider causes the other slider to track keeping the width of the wedge
      constant, while moving it across the range of data values. Normally,
      the sliders are independent. The width of the wedge is fixed when this
      button is pressed. "Independent" Sliders removes the connection.

   Type:
      Exclusive buttons.

   Format/Usage:
      Press the "Gang" button to connect the "Stretch Bottom" and "Stretch
      Top" Sliders. Press the "Independent" button to disconnect "Stretch
      Bottom" and "Stretch Top".

   Range of Values:
      ---

   Notes on Values:
      Default is "Independent".

   Availability/Indirect Effects:
      Always available, if "Options" button is activated.


6) === Exclusive BUTTONS for Top ===
```

```
   Purpose:
      When set to "Clip", values larger than "Stretch Top" are set to the
      largest color index. If set to "Chop", values larger than "Stretch Top"
      are set to color index 0.

   Type:
      Exclusive buttons.

   Format/Usage:
      Press the "Clip" button for setting larger color values than the
      "Stretch Top" value to the largest color index. Press the "Chop"
      button to set values larger than "Stretch Top" to color index 0.

   Range of Values:
      ---

   Notes on Values:
      Default is "Clip".

   Availability/Indirect Effects:
      Always available if "Options" button is activated.


7) === Exclusive BUTTONS for Stretch ===

   Purpose:
      When "Stretch" is set to the default "Indices", manipulations effect
      the mapping between color indices and color table triples. When set
      to "Intensity", the mapping individually controls the intensity of each
      color table entry. This is useful when displaying quantized images,
      where the pixel value is arbitrary and does not represent an intensity.
      In this mode, the hue and saturation remain relatively constant for a
      given color index.

   Type:
      Exclusive buttons.

   Format/Usage:
      Press the "Indices" button to allow manipulations to affect the mapping
      between color indices and color table triples. Press the "Intensity"
      button to allow the mapping to individually control the intensity of
      each color table entry.

   Range of Values:
      ---

   Notes on Values:
      Default is "Indices".

   Availability/Indirect Effects:
      Always available if "Options" button is activated.


8,9,10) === BUTTONS for Reverse Table, Replace-, Restore Original Table ===

   Purpose:
      These three buttons are pre-defined Color Table buttons. Pressing
      one of these buttons loads the selected pre-defined color table.
      The settings of the other controls are not affected.

   Type:
      Three inclusive buttons.

   Format/Usage:
      Press the "Reverse Table" button to reverse the current color table.
      Press the "Replace Original Table" button or the "Restore Original
      Table"-button to replace or to restore the original color table.

   Range of Values:
      ---
```

```
    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available if "Options" button is activated.


INPUT EXAMPLE(S)

- Set gamma correction to approx. 1.1:
   Drag the Gamma Correction Slider with the mouse to approx. 1.1 (you
   may get 1.096 finally).
```

8.10.3 Color Functions

```
GENERAL DESCRIPTION

Plot Colors is a widget based utility for the interactive manipulation of
color tables. It may be used with any EGOPS plot applications. The color
table maps the data values written to the screen to different colors and
intensities. Its operation is similar to that of a photographic wedge.
The slope and position of the wedge are manipulated to best display a
particular data set.


SPECIAL NOTES/HINTS

- "Plot Colors" is a modified version of the "XLoadCT" widget tool
  contained in the IDL software package.
- The current color table is always shown in the draw window above the
  first button row.


INPUT PARAMETER(S)

1) === Exclusive BUTTON for Function ===

    Purpose:
       Activates Transfer Function widgets for Reset Transfer Function,
       Add Control Point, Remove Control Point, and display the
       corresponding Draw Window.

    Type:
       Exclusive button.

    Format/Usage:
       Press the "Function" button to show the three buttons for the Reset
       Transfer Function, Add Control Point, Remove Control Point, and
       show the corresponding Draw Window.

    Range of Values:
       ---

    Notes on Values:
       ---

    Availability/Indirect Effects:
       Always available.


 2,3,4) === BUTTONS for Reset Transfer Function, Add-, Remove Control Point ===

    Purpose:
       Allows interactive editing of the Transfer Function (mapping of color
       table values to color indices) by dragging control points on a plot of
       the transfer function. (Select and move control points by clicking and
       dragging them in the draw window - see below.)
       You can add a control point, in the largest interval that contains
```

```
      no control points, with the "Add Control Point" button. The "Remove
      Control Point" button removes the central control point in the
      smallest interval containing three control points. The "Reset Transfer
      Function" button restores a linear one-to-one transfer function.

   Type:
      Three non-exclusive buttons.

   Format/Usage:
      Press the "Reset Transfer Function" button to restore a linear
      one-to-one transfer function. Press the "Add Control Point" button
      to add a control point in the largest interval containing no control
      point. Press the "Remove Control Point" button to remove the central
      control point in the smallest interval containing three control points.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available if "Function" button is activated.


5) === DRAW WINDOW for interactive editing of color table values ===

   Purpose:
      This window allows interactive modification of the transfer function
      by dragging control points on a plot of the transfer function.
      Select and move a control point by clicking and dragging on its symbol.
      The first and last control points may only be moved in the vertical
      direction. Other control points may be moved anywhere within the plot
      as long as they are to the right of their predecessors and to the left
      of the following control points.

   Type:
      User I/F: Draw window.

   Format/Usage:
      Select and move the control points by clicking and dragging on their
      symbols.

   Range of Values:
      ---

   Notes on Values:
      ---

   Availability/Indirect Effects:
      Always available, if "Function" button is activated.


INPUT EXAMPLE(S)

- Add a control point:
   Press "Add Control Point" button.
```

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